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CARTER CENTER

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Summary
2015 Program Review

RIVER BLINDNESS ELIMINATION PROGRAMS

Ethiopia, Nigeria, OEPA, Sudan, and Uganda

2-4 March 2016
The Carter Center
Atlanta, GA

October 2016

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And to many others, our sincere gratitude.

*We appreciate the support of the donors listed here, whose funding was utilized in 2015 for the activities described in these proceedings.

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ACRONYMS

APOC	African Program for Onchocerciasis Control
ATO	Annual Treatment Objective
BCC	Behavior Change Communication
CBM	Christoffel Blindenmission
CDC	Centers for Disease Control and Prevention
CDD	Community Directed Distributors
CDHS	Community-Directed Health Supervisors
CDTI	Community-Directed Treatment with Ivermectin
DDT	Dichlorodiphenyltrichloroethane
DEC	Diethylcarbamazine
DRC	Democratic Republic of Congo
EOEEAC	Ethiopia Onchocerciasis Elimination Expert Advisory Committee
ELISA	Enzyme-linked immunosorbent assay
EPHI	Ethiopia Public Health Institute
FMOH	Federal Ministry of Health
GOS	Government of Sudan
GSK	GlaxoSmithKline
IACO	InterAmerican Conference on Onchocerciasis
IRB	Institutional Review Board
IVT	International Verification Team
KAP	Knowledge Attitude & Perceptions
KGaA	E-Merck
LCIF	Lions Clubs International Foundation
LF	Lymphatic Filariasis
LGA	Local Government Areas
LLIN	Long Lasting Insecticidal (bed) Net
MDA	Mass Drug Administration
MDP	Mectizan® Donation Program
Mectizan®	Ivermectin (Merck & Co., Inc., product name)
MITOSATH	Mission to Save The Helpless
MOA	Memorandum of Agreement
MOH	Ministry of Health
NOEC	The Nigerian Onchocerciasis Elimination Committee
NOEC	National Onchocerciasis Elimination Committee
NGDO	Non-Governmental Development Organization
NOCP	National Onchocerciasis Control Program
NOTF	National Onchocerciasis Task Force
NTDs	Neglected Tropical Diseases
OEPA	Onchocerciasis Elimination Program for the Americas

ACRONYMS (Continued)

PAHO	Pan American Health Organization
PATH	Program for Appropriate Technology in Health
PCC	Program Coordinating Committee of OEPA
PCR	Polymerase Chain Reaction
PTS	Post-Treatment Surveillance
RB	River Blindness
RBF	River Blindness Foundation
RBEP	River Blindness Elimination Program
REMO	Rapid Epidemiological Mapping of Onchocerciasis
RSS	Republic of South Sudan
RTI	Research Triangle Institute
SAE	Severe Adverse Events
SIZs	Special Intervention Zones
STH	Soil Transmitted Helminths
TAS	Treatment Assessment Survey
TCC	The Carter Center
TDA	Triple Drug Administration
TDR	Tropical Disease Research
UOEEAC	Ugandan Onchocerciasis Elimination Expert Advisory Committee
USAID	United States Agency for International Development
USF	University of Southern Florida
UTG	Ultimate Treatment Goal
VAS	Vitamin A Supplementation
WHO	World Health Organization

Figure ES1

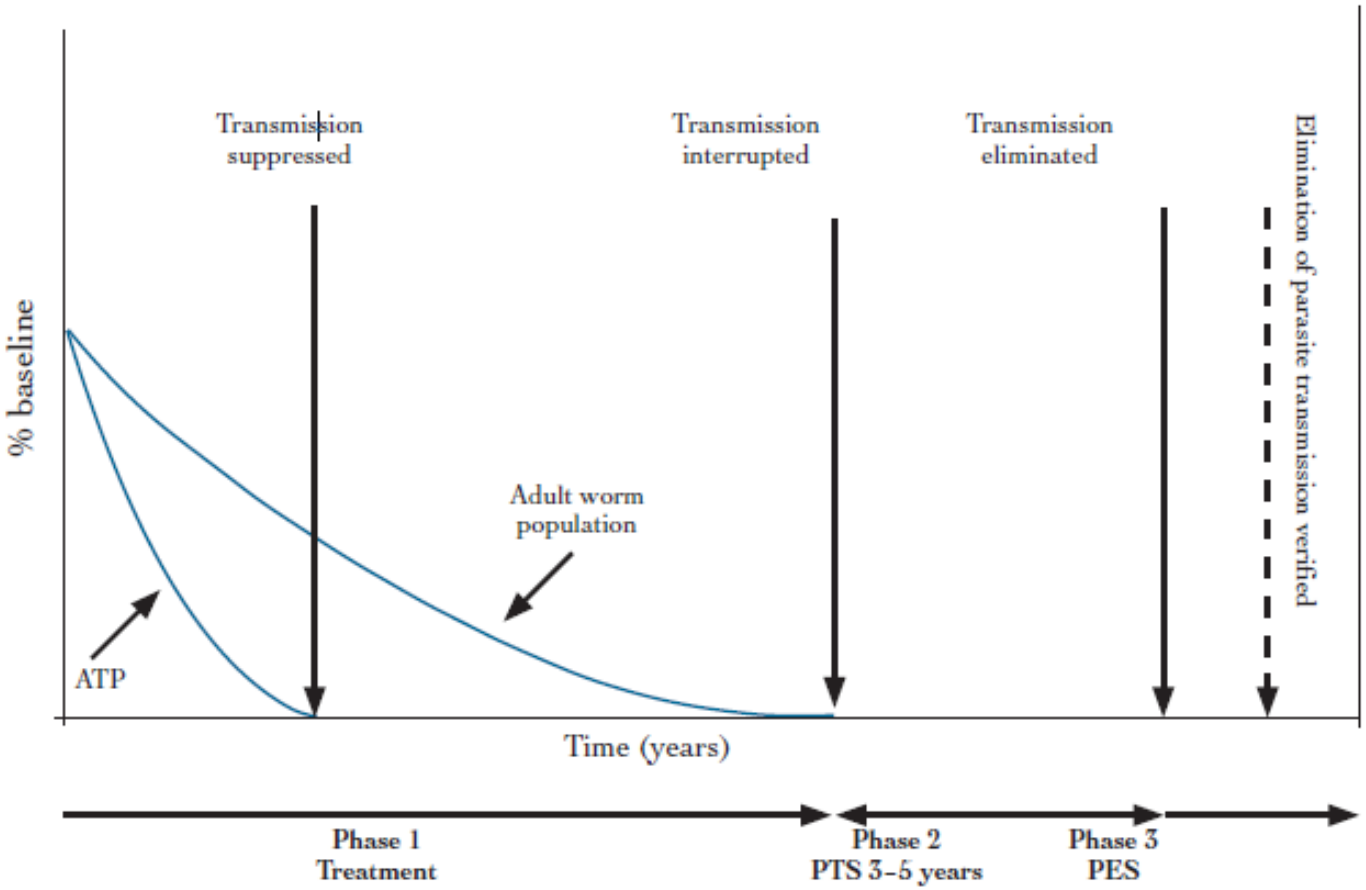
2015 River Blindness Elimination Program Review Participants

Figure ES2

20 Years of Carter Center River Blindness Reviews! (1996-2015)

Figure ES3

Phases of the Elimination of Onchocerciasis (from the new 2016 WHO guidelines*)



ATP, annual transmission potential; PES, post-elimination surveillance; PTS, post-treatment surveillance

*WHO (2016). Guidelines for stopping mass drug administration and verifying elimination of human onchocerciasis: criteria and procedures (document WHO/HTM/NTD/PCT/2016.1). Geneva, World Health Organization. http://www.who.int/onchocerciasis/resources/9789241510011/en/

Figure ES4

RBEP-Assisted Programs: Ivermectin Treatments 1996 – 2015 and 2016 Target

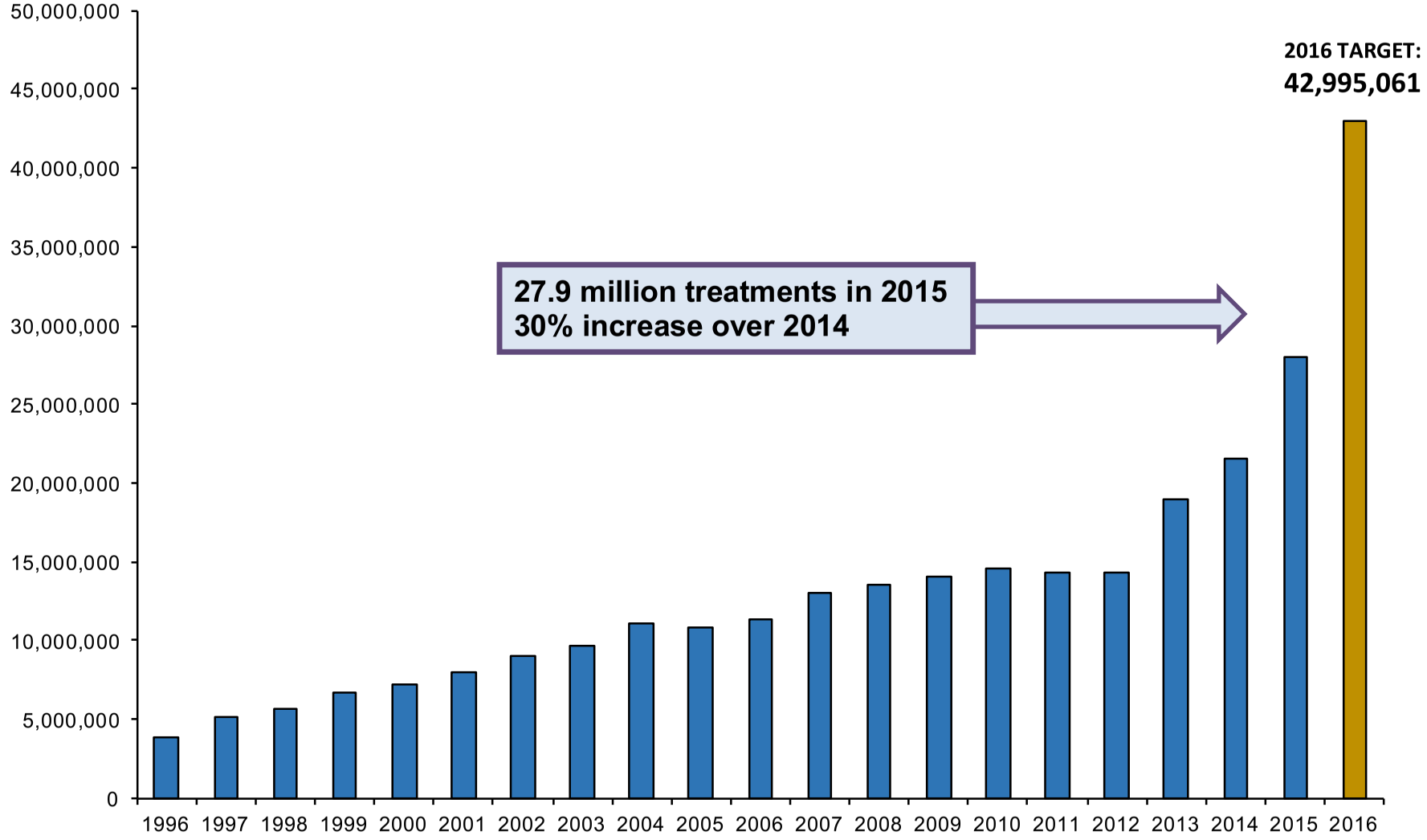


Figure ES5

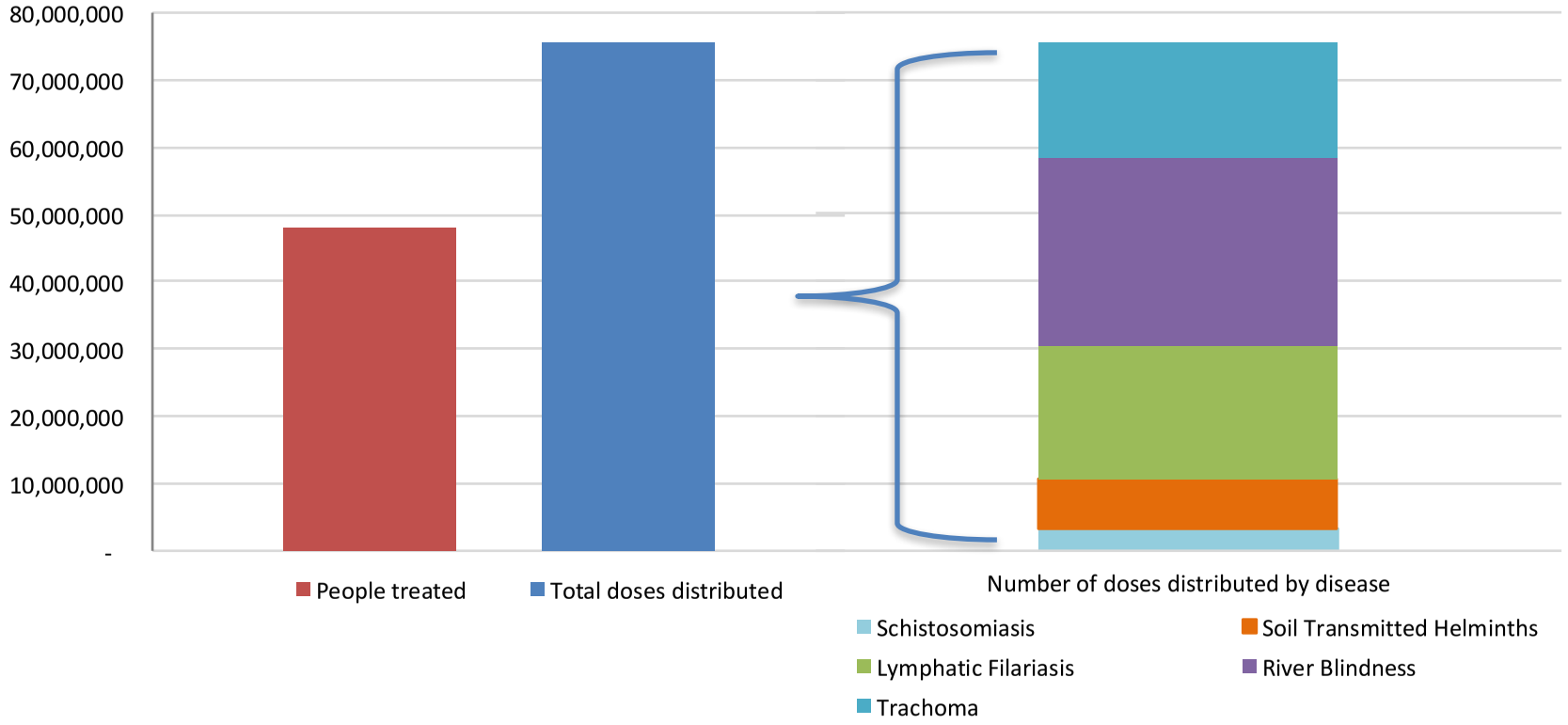
2015 Mectizan® Mass Treatment Figures for Carter Center RBEP- Assisted Areas in Latin America (OEPA) and Sudan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	% UTG	% ALL RBP TX
NIGERIA	***UTG=**	**9,749,216**			**UTG (villages)=**	**18,257**									
Treatments	0	0	0	0	65,574	554,197	900,127	1,472,766	1,431,165	916,057	1,351,986	2,203,243	**8,895,115**	**91%**	**32%**
Villages treated	0	0	0	0	15	450	1,092	3,534	2,814	1,142	1,979	4,848	**15,874**	**87%**	**39%**
NIGERIA ELIMINA	****UTG=**	**272,972**			**UTG (villages)=**	**338**									
Treatments	0	0	0	0	0	0	0	0	0	0	0	354,615	**354,615**	**130%**	**1%**
Villages treated	0	0	0	0	0	0	0	0	0	0	0	338	**338**	**100%**	**1%**
UGANDA	***UTG=**	**10,237**			**UTG (villages)=**	**7**									
Treatments	0	0	0	0	8,826	0	58	0	0	0	0	0	**8,884**	**87%**	**0%**
Villages treated	0	0	0	7	0	0	0	0	0	0	0	0	**7**	**100%**	**0%**
UGANDA ELIMINA	****UTG(2)=**	**3,780,908**			**UTG (villages)=**	**3,742**									
Treatments	0	0	0	101,427	606,031	735,348	200,104	0	0	852,038	875,401	0	**3,370,349**	**89%**	**12%**
Villages treated	0	0	0	397	0	1,431	277	0	0	368	1,269	0	**1,871**	**50%**	**5%**
OEPA	****UTG(2)=**	**17,640**			**UTG (villages)=**	**147**									
Treatments	0	0	0	0	0	8,053	0	0	0	0	0	8,214	**16,267**	**92%**	**0%**
Villages treated	0	0	0	0	0	144	0	0	0	0	0	145	**145**	**98%**	**0%**
OEPA	****UTG(4)=**	**57,444**			**UTG (villages)=**	**313**									
Treatments	0	0	10,681	0	0	11,608	0	0	0	11,301		11,114	**44,704**	**78%**	**0%**
Villages treated	0	0	268	0	0	288	0	0	0	278		269	**276**	**88%**	**1%**
ETHIOPIA	***UTG=**	**479,703**			**UTG (villages)=**	**1,649**									
Treatments	0	0	0	0	0	316,380	160,486	0	0	0	0	0	**476,866**	**99%**	**2%**
Villages treated	0	0	0	0	0	1,184	0	373	0	0	0	0	**1,557**	**94%**	**4%**
ETHIOPIA ELIMIN	****UTG(2)=**	**16,118,210**			**UTG (villages)=**	**41,974**									
Treatments	0	0	0	0	0	2,078,765	243,473	4,384,261	5,708	241,001	51,120	7,653,384	**14,657,712**	**91%**	**52%**
Villages treated	0	0	0	0	0	10,221	536	24,351	0	1,237	0	3,619	**19,982**	**48%**	**50%**
SUDAN	****ATO=**	**23,427**			**UTG (villages)=**	**20**									
Treatments	0	0	0	0	0	0	0	0	0	0	3,531	31,233	**34,764**	**148%**	**0%**
Villages treated	0	0	0	0	0	0	0	0	0	0	24	0	**24**	**120%**	**0%**
SUDAN ELIMINAT	****UTG(2)=**	**246,180**			**UTG (villages)=**	**153**									
Treatments	0	0	0	95,955	11,115	0	0	0	0	0	0	0	**107,070**	**43%**	**0%**
Villages treated	0	0	0	152	0	0	0	0	0	0	0	0	**152**	**99%**	**0%**
TOTALS	***UTG=**	**30,755,937**			**UTG (villages)=**	**66,255**									
Treatments	**-**	**-**	**10,681**	**197,382**	**682,720**	**3,704,351**	**1,504,190**	**5,857,027**	**1,436,873**	**2,020,397**	**2,282,038**	**9,907,188**	**27,966,346**	**91%**	
Villages treated	**-**	**-**	**268**	**549**	**15**	**13,718**	**1,905**	**28,258**	**2,814**	**3,025**	**3,272**	**8,881**	**40,225**	**61%**	

*UTG: Ultimate Treatment Goal (all the treatment-eligible population in a program area, i.e. healthy persons >5 years of age)
**OEPA's UTG 2 and UTG 4 are the UTG times 2 or 4. OEPA treatments are semiannual or quarterly
***ATO: Annual Treatment Objective – used because the population is unknown

Figure ES6

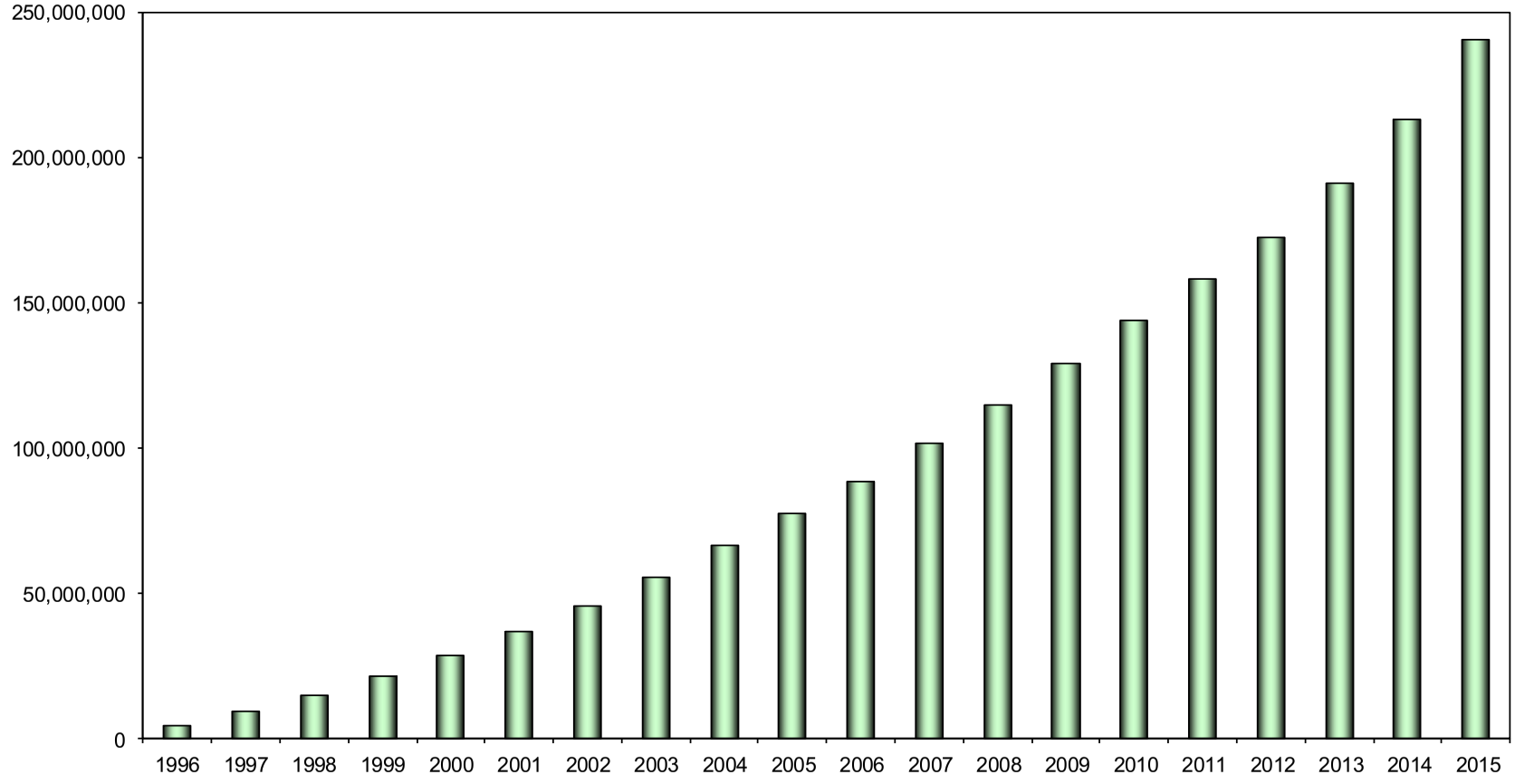
Carter Center-supported Treatment Doses, and Persons Treated, for Neglected Tropical Diseases, 2015*



** The Carter Center is grateful for our Ministry of Health partners and the many donors and pharmaceutical companies who have made financial and in-kind contributions to make these treatments possible.*

Figure ES7

241 Million Mectizan® Cumulative Doses (Treatments) for RB Delivered by Carter Center RBEP-Assisted Programs, 1996 – 2015



RB = River Blindness, RBEP = River Blindness Elimination Program

Figure ES8

Carter Center-Assisted Programs: 1996 – 2015 Mectizan® Treatments by Program

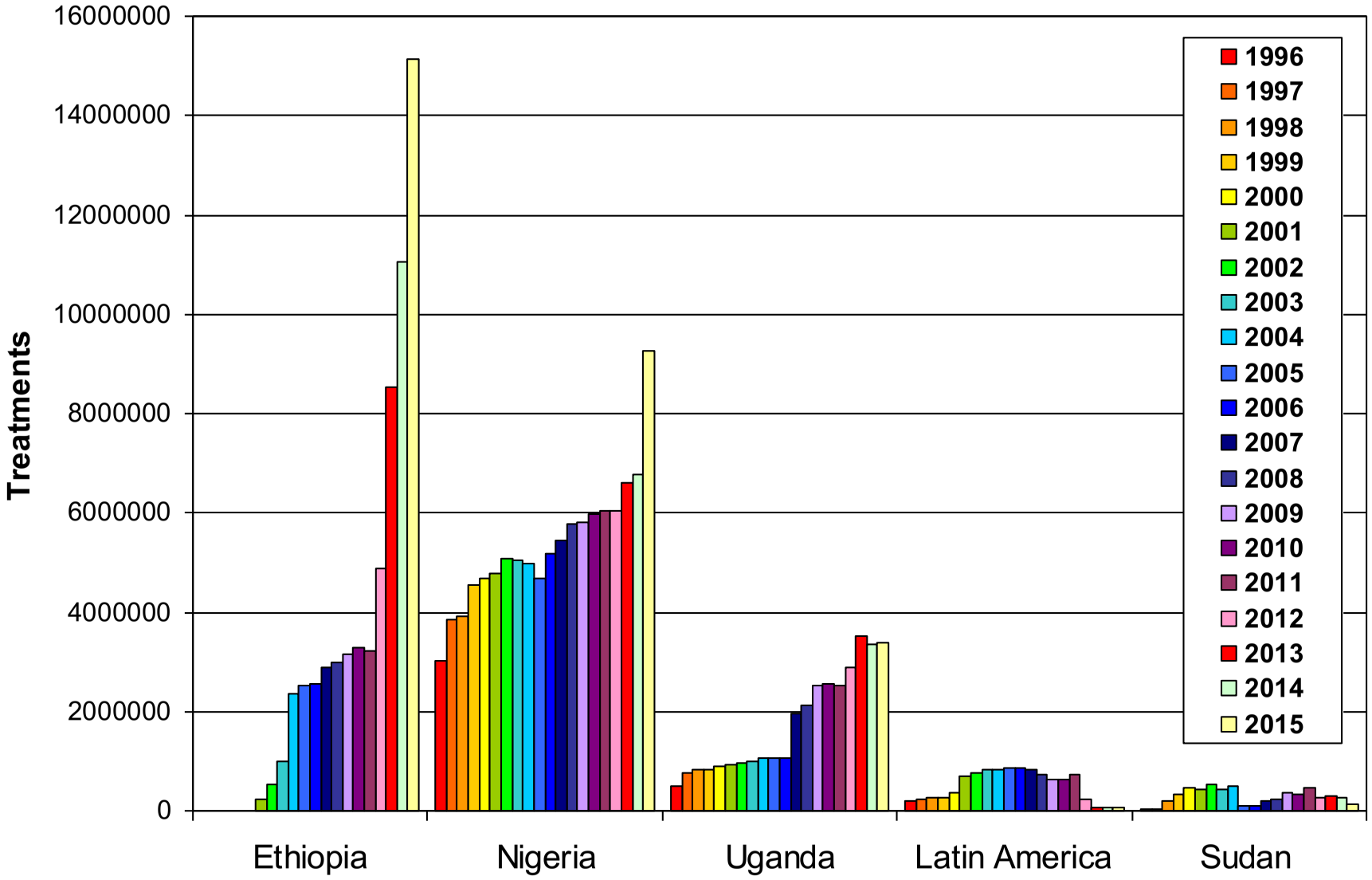
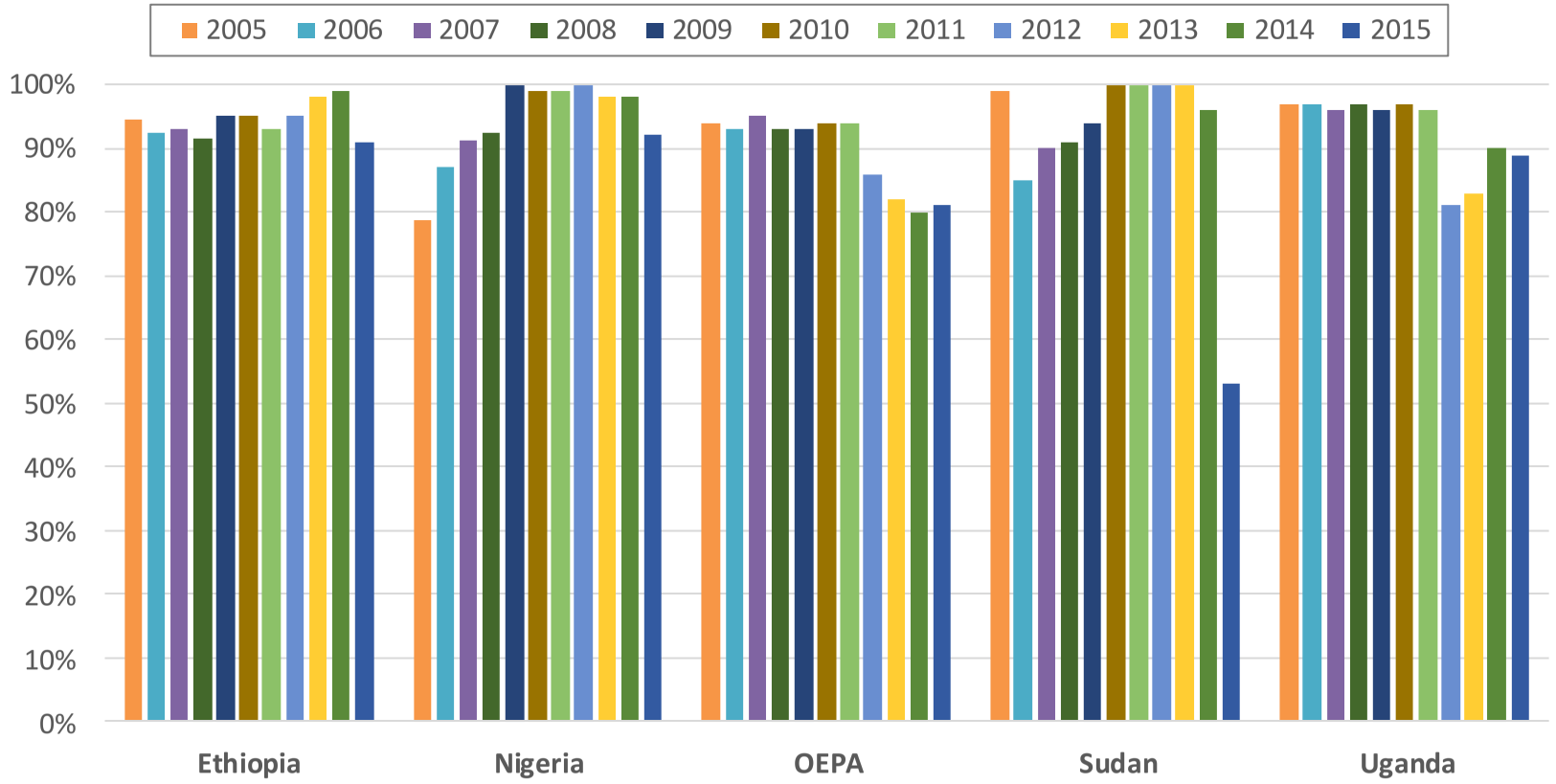


Figure ES9

River Blindness Program: Reported Treatment Coverage (eligible population) by Project: UTG, UTG(2) or UTG(4) 2005 – 2015



Decreasing coverage in OEPA, Sudan and Uganda are the result of these programs' focus on their final transmission zones, which are of most difficult access.

Figure ES10

Community–Directed Distributors (CDDs) Trained 2004 – 2015 and 2016 Projections

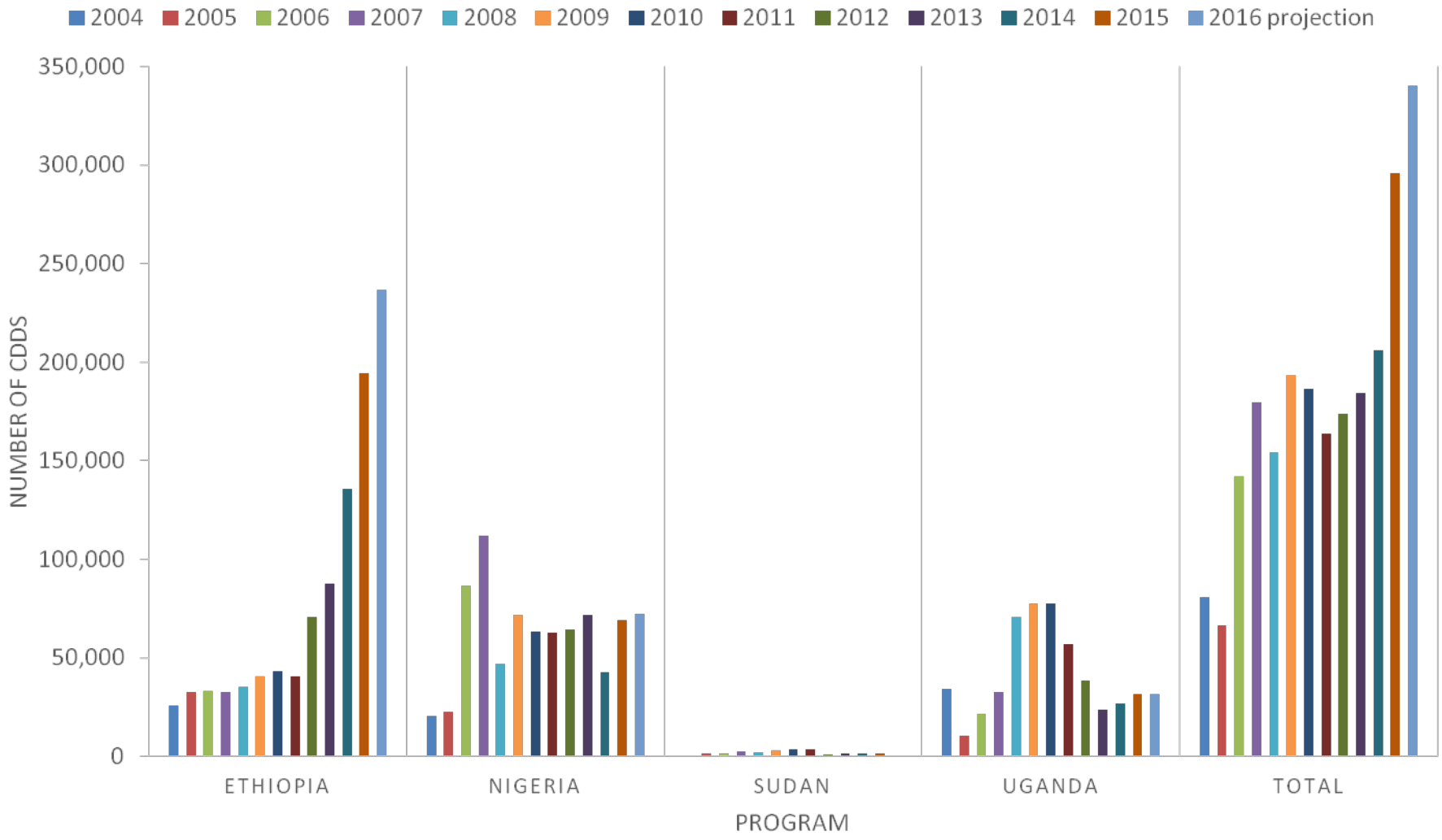
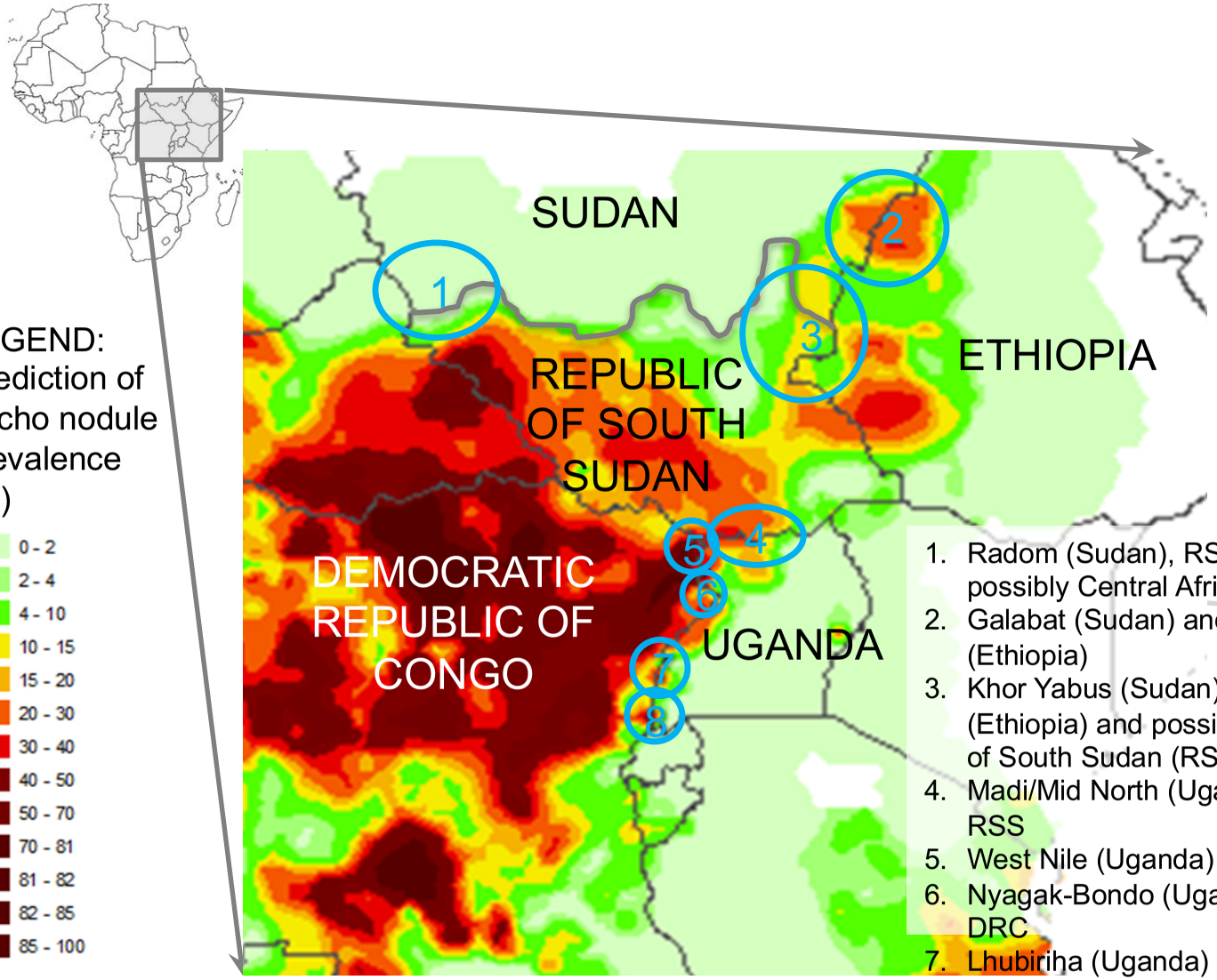


Figure ES11

Carter Center-Assisted Special Intervention Zones in Ethiopia, Sudan and Uganda



REMO map source: APOC

Figure ES12

Ethiopia: Training of Community-Directed Drug Distributors: 2001 – 2015 and Percentage Female

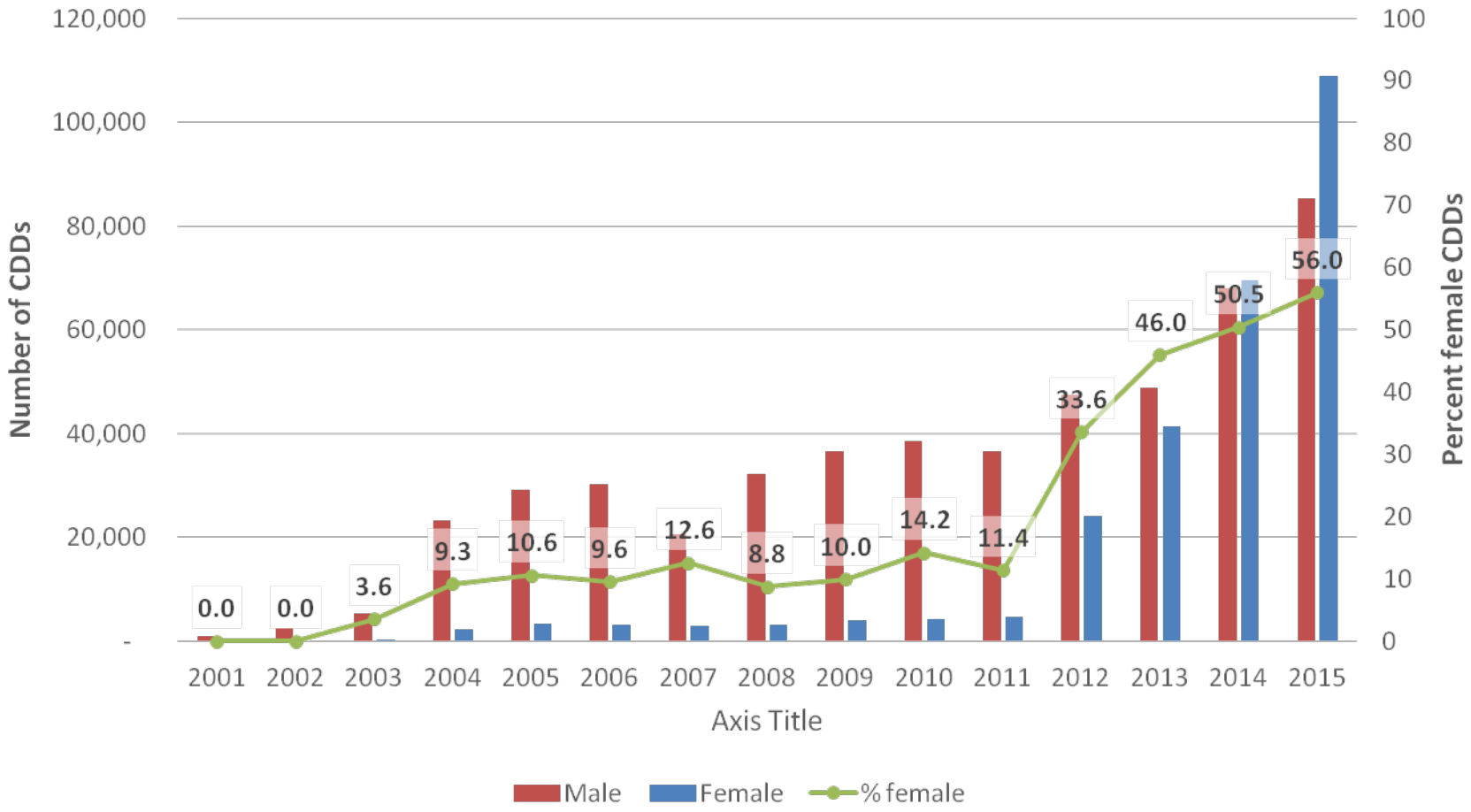
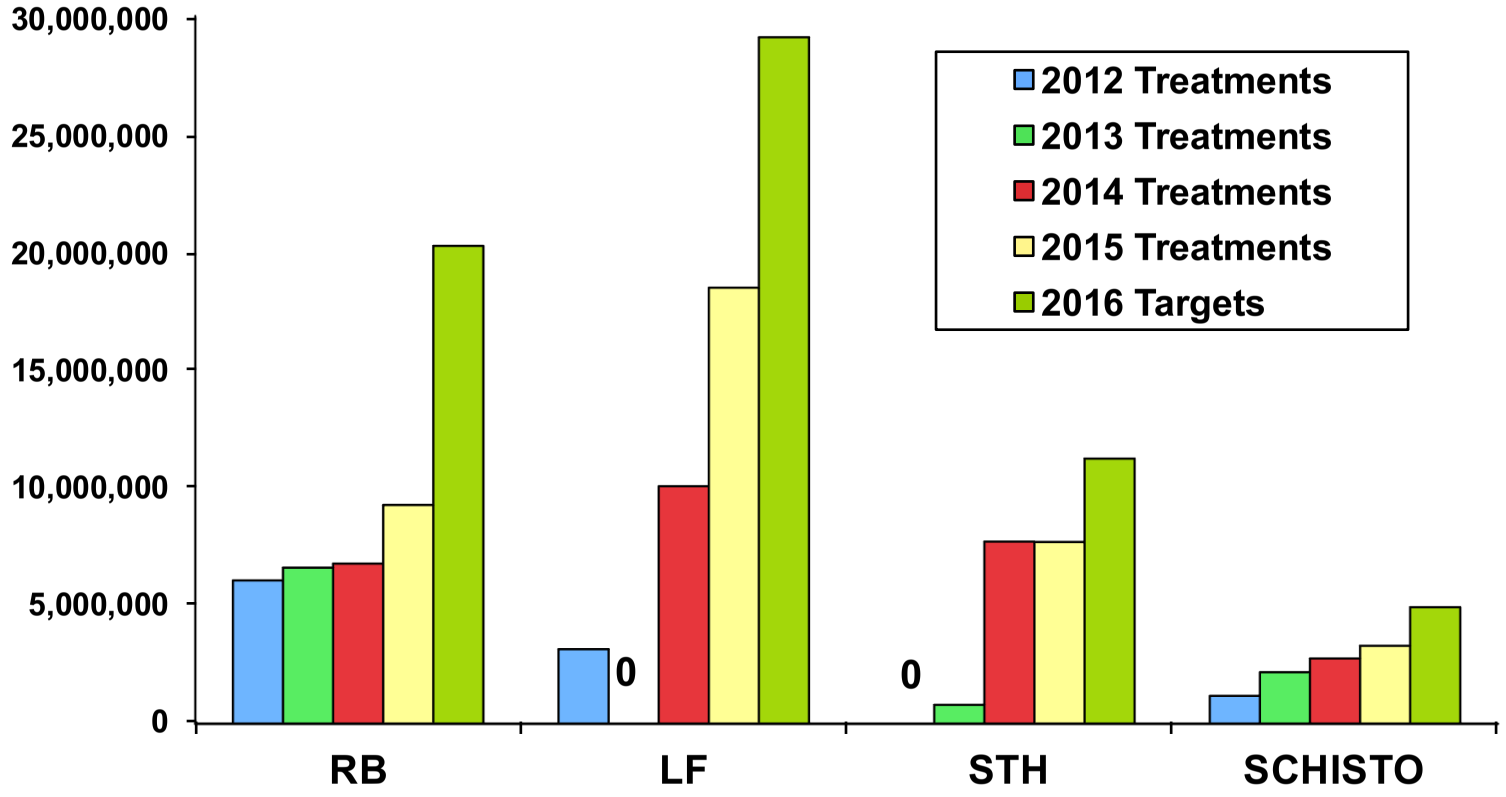


Figure ES13

Nigeria: Carter Center Assisted River Blindness (RB), Lymphatic Filariasis (LF), Soil Transmitted Helminths (STH) and Schistosomiasis (SCH) Treatments 2012 – 2015 and 2016 Targets



2015: 39 million total treatments 2016 target: 65 million total treatments (70% increase)

Figure ES14

Uganda
Change in Endemic Status in Foci (n = 17) over Time

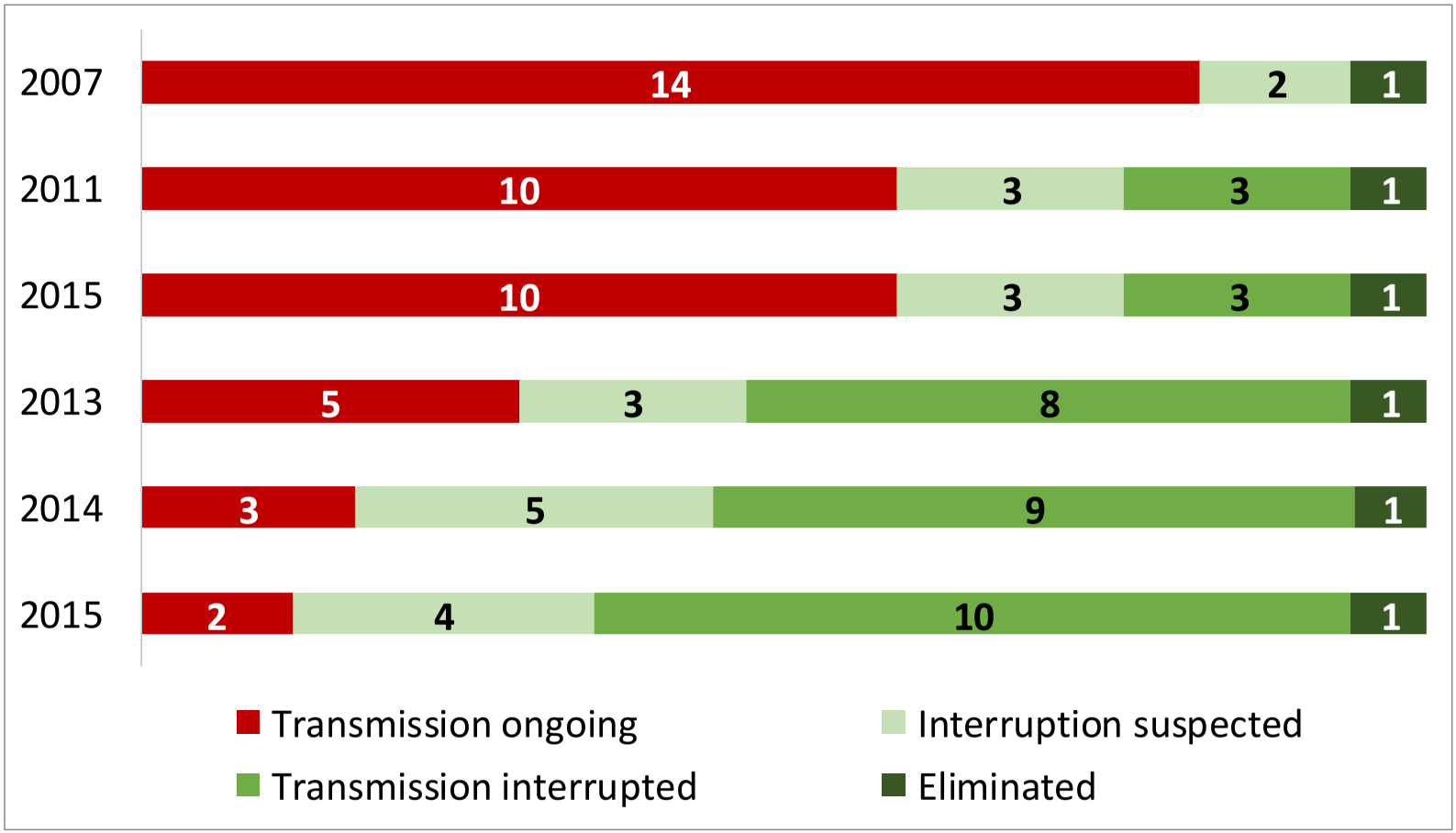


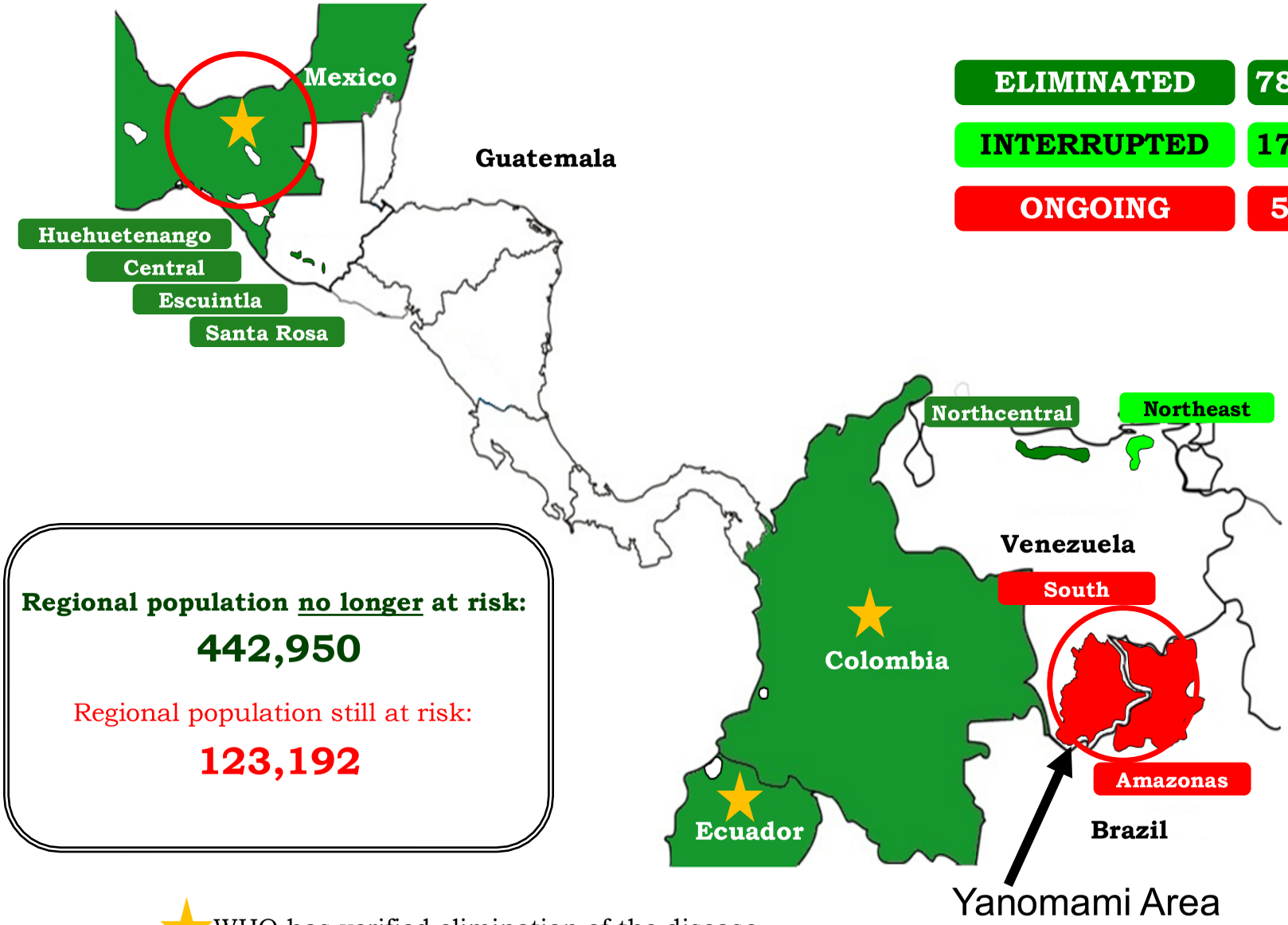
Figure ES15

The Hon. Federal State Minister of Health, Dr. Sumaia Declares Onchocerciasis as being Eliminated from the Abu Hamad Focus (Khartoum, October 2015)

From Left: Dr. Balgesa Elkhair (National Blindness Control and Prevention), Hon. Victoria Sumaia Idris Akad (Federal State Minister of Health), Dr. Nabil Aziz (Carter Center Sudan Country Representative), Hon. Dr. Hassan Adburrahman (River Nile State, Minister of Health), Dr. Naeema Hasan Al-Gasseer (WHO Representative, Sudan), Dr. Frank Richards (Carter Center)

Figure ES16

Onchocerciasis in the Americas (December 2015)



ABSTRACT

The 20th Review of the integrated River Blindness Elimination Program (RBEP) of The Carter Center (TCC) was held from 2 – 4, March 2016 (meeting photo, Figure ES1). The 20-meeting mark was commemorated with a birthday cake and reception (Figure ES2). Participants (a number of whom have attended all 20 reviews) included TCC headquarters and field staff, ministry of health officials of countries assisted by RBEP, and key partners and donors. The Review focused on the 2015 RBEP achievements, challenges, and operational research. A major goal each year is to provide recommendations for each program, which are included as a major focus of this report.

The goal of the RBEP is to eliminate river blindness (RB) transmission everywhere it assists ministries of health (MOHs) in 10 countries[1]. The approach to RB elimination is defined by World Health Organization (WHO) guidelines, which provide three milestones (shown by the vertical lines in Figure ES3): 1) Transmission suppressed; 2) Transmission interrupted; and 3) Transmission eliminated. The strategy for elimination in RBEP programs is mass drug administration (MDA) with ivermectin (Mectizan®, donated by Merck), together with health education, preferably given twice per year (six monthly). RBEP assisted efforts in the Americas have resulted in WHO verified national elimination of onchocerciasis from Colombia (2013), Ecuador (2014) and in 2015, Mexico. The Abu Hamad focus in Sudan was the first focus in Africa to complete the WHO elimination guidelines. The 2015 Review identified cross border program challenges as a major issue and called for cross border transmission areas 'Special Intervention Zones' (SIZs).

In 2015, the RBEP and its partners provided nearly 28 million Mectizan® treatments for RB (Figures ES4 and A5), representing about 37% of the 75 million MDA treatments assisted by Carter Center for neglected tropical diseases (NTDs) (Figure ES6). RB is TCC's largest MDA program. From 1996 to 2015, TCC's RBEP cumulatively has assisted about 241 million Mectizan® treatments (Figure ES7). Figure ES8 shows these treatments by program, and Figure ES9 shows annual treatment coverage by program. RBEP consistently provided >90% reported treatment coverage of the eligible population (which excludes pregnant women and children over five years of age), except in the Americas where the goal is >85%.

RBEP is an integrated program with similar MDA interventions against lymphatic filariasis (LF), malaria, schistosomiasis, soil-transmitted helminthiasis (STH), and trachoma when feasible. These other diseases were discussed during the review: 2015 treatments for LF were 19,573,246, for schistosomiasis 3,292,601, and for STH 7,683,255. Most of these treatments occurred in Nigeria.

The integrated program would not be possible without a grassroots network of community-directed drug distributors. A combined 354,836 community workers, many of whom are volunteers (Figure ES10).

[1] Brazil, Colombia, Ecuador, Ethiopia, Guatemala, Mexico, Nigeria, Sudan, Uganda and Venezuela

EXECUTIVE SUMMARY OF THE 20TH PROGRAM REVIEW

Dr. Frank Richards, director of TCC's River Blindness, Lymphatic Filariasis, and Schistosomiasis Programs, co-chaired the meeting with the RBEP field office leaders: Dr. Nabil Aziz (Country Representative, Sudan), Ms. Peace Habomugisha (Country Representative, Uganda), Dr. Emmanuel Miri (Country Representative, Nigeria), Dr. Mauricio Sauerbrey (Director, Onchocerciasis Elimination Program for the Americas-OEPA), and Dr. Zerihun Tadesse (Country Representative, Ethiopia). In addition to Carter Center field and headquarters staff, attendees included representatives from: the ministries of health of Ethiopia, Nigeria, Sudan, and Uganda; U.K. Department for International Development; Emory University; The END Fund; Izumi Foundation; Lions Clubs International Foundation; Liverpool John Moores University; Mectizan® Donation Program; Ohio University; PATH; Rabin Martin; RTI International; Sightsavers; Task Force for Global Health; University of Notre Dame; University of South Florida; U.S. Agency for International Development (USAID); U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). Key findings and country reports follow. (See Annexes 1 – 8 for background on the diseases, a program achievement timeline, a complete participant list, contact list, publications, and the Review agenda).

A new general recommendation from the 2015 Review was for the need to establish binationally coordinated 'Special Intervention Zones' (SIZs) for cross-border onchocerciasis transmission areas by all RBEP country offices. The idea is that transmission must be simultaneously tackled on all sides of the SIZ if the elimination initiative is to be successful. One side cannot be 'left behind,' and engaging both sides involves not only technical activities, but political and diplomatic as well. SIZ issues are relevant both in the Americas and in Africa. The 'final' inch to achieving regional elimination in the America is the Yanomami Area SIZ that straddles the border between Brazil and Venezuela. In Africa, the SIZs currently addressed are: the adjacent Galabat (Sudan) and Metema (Ethiopia) transmission zones, both of which are close to reaching an agreement for coordinated stopping of MDA; Sudan's Khor Yabus focus adjacent to Ethiopia's Nuer focus (Gambella), which also may extend into a very insecure area of the Republic of South Sudan; the Radom focus of Sudan, another very unstable SIZ that extends into RSS and possibly Central Africa Republic; the Madi/Mid North focus of Uganda, which extends into RSS; and four Ugandan foci (Bwindi, Lhubiriha, Nyagak-Bondo, and West Nile foci) that extend into DRC (See Figure ES11 for a map of these areas). We also consider the internal state border of Edo and Ondo states in Nigeria a "SIZ." Although these are both within the same country, there is an important cross border transmission zone between Edo State (supported by The Carter Center and Ondo (supported by an NGO called MITOSATH). All RBEP SIZs in the Americas and Africa will require considerable diplomatic and programmatic work to intensify interventions.

Ethiopia

Ethiopia continued its strong performance in its third year of conducting primarily twice-per-year treatments for river blindness, aggressively pursuing the national policy of onchocerciasis elimination by 2020. In 2015, Ethiopia delivered the most Mectizan®

treatments of our assisted programs; a total of 15,134,758 treatments were provided with 14.6 million of these in the twice-per-year strategy (Figure ES5). Over 194,000 community drug distributors were trained, approximately 56,000 more than in 2014, and more than half were female (Figure ES12). The Carter Center's work in Ethiopia is based on a longstanding partnership with the Federal Ministry of Health, The Lions Clubs International Foundation SightFirst Program and the Lions Clubs of Ethiopia. Ethiopia also continued treatments for lymphatic filariasis, reaching 1.1 million treatments in a program supported by GSK.

Nigeria

Thanks to NTD funding from USAID's ENVISION project, led by RTI International, and funding from Sir Emeka Offor Foundation and Cargill Foundation, our program assisted nearly 39 million treatments for river blindness, LF, SCH and STH in Nigeria in 2015 (Figure ES13). RBEP assisted in 9,249,730 Mectizan® treatments for river blindness. The Nigeria Onchocerciasis Elimination Committee (NOEC) was launched to development a national approach to elimination oriented around new WHO guidelines; NOEC convened twice in 2015 and intends to meet at least twice in 2016. For the first time in Nigeria, twice per year Mectizan® treatments for RB were provided in Edo state in an area where ongoing onchocerciasis transmission has been documented after many years of annual treatment.

The LF Elimination Program focused on documenting the interruption of transmission in Plateau and Nasarawa states where LF treatments (a combination of Mectizan® and albendazole, the latter donated by GSK) stopped by 2013. The Carter Center provides technical assistance for Transmission Assessment Surveys (TAS), and will be conducting operational research studies on LF post-treatment surveillance in former hot spots of ongoing transmission in 2016, with support from the Task Force for Global Health. In the seven southern states the LF program assisted the state ministries of health to provide 18,458,493 treatments. Twice-per-year treatments with albendazole monotherapy were planned in 2015 in *Loa loa* areas where Mectizan® is not recommended due to the risk of severe adverse events. Unfortunately, these treatments did not occur when albendazole arrived too late in country to provide the first semester MDA. In 2016 the program will again attempt twice-per-year treatments, which, if successful, would increase LF treatments by 61% to 29 million.

The Carter Center's integrated malaria-LF program assisted the Nigerian National Malaria Program to distribute 2,065,753 long lasting insecticidal nets (LLIN) in 2015; cumulatively the program has assisted with the distribution of 11,506,455 nets since 2004. Thanks to support from the Clarke Cares Foundation, the program continues to work on innovative NTD-Malaria integrated strategies for net distribution and use promotion, in support of the Federal Ministry of Health (FMOH) Guidelines for malaria-LF co-implementation in Nigeria

The Carter Center assisted in 3,292,601 praziquantel treatments for schistosomiasis in six states in 2015. Praziquantel is donated to The Carter Center through the World Health Organization by Merck KGaA (E-Merck) of Germany. The Izumi Foundation supports this

program in four of the six states. Our target in 2016 is 4,922,191 (a 26% increase). Treatments in 2015 for STH were 7,683,255 with a 2016 target of 11 million (a 44% increase). The medicines used for STH treatment are donated by GSK (albendazole) or Johnson & Johnson (mebendazole).

Uganda

The Uganda program administered 3.4 million Mectizan® treatments in 2015. Uganda has stopped MDA in 8 of 17 endemic transmission zones (Figure ES14). Treatment in two more transmission zones (Wadelai and Maracha-Terego) could not be stopped due to co-endemicity with LF where ivermectin with albendazole MDA must continue. In 2016, the remaining onchocerciasis endemic districts of Uganda will be treating twice per year, with a target of 3.9 million treatments. In 2015, the Ugandan Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) recommended treatments be halted in Nyamugasani focus. The committee also noted that 7 foci (Kashoya-Kitomi, Mt. Elgon, Imaramagambo, Itwara, Mpamba-Nkusi, Wambabya-Rwamarongo, and Wadelai) needed to complete the evaluations required for the end of the three-year post-treatment surveillance (PTS) monitoring period in 2016 (see Figure ES3). Although not required by WHO, the UOEEAC recommended that these evaluations include serological OV16 antibody assessments among children under 10 years of age. It is hoped that successful completion of these evaluations will mean that the four foci (with their combined populations of 3.8 million) will be moved to the WHO category of disease eliminated.

Sudan

In 2015, the Sudan Federal Ministry of Health declared that the Abu Hamad focus (population of 100,000 persons) had eliminated onchocerciasis transmission after the focus passed its three PTS entomological and serological evaluations (for which The Carter Center provided assistance). Abu Hamad was the first focus in Africa to be so declared under WHO Geneva guidelines (Figure ES15). Sudan's Ministry of Health delivered 141,834 treatments in 2015, and has determined that onchocerciasis transmission has been interrupted in its Galabat focus.

The Americas

RBEP's Onchocerciasis Program for the Americas (OEPA) supports a coalition with the goal of eliminating transmission of onchocerciasis from the Region of the Americas. Over 500,000 were at risk of onchocerciasis in 13 transmission zones (foci) when OEPA began in 1993 (Figure ES16). In 2015, Mexico received verification of onchocerciasis transmission elimination from WHO. It is only the third country in the world to reach this status. Guatemala, which submitted its elimination dossier to WHO in March 2015, and was visited by a WHO International Verification Team in May 2016. Ivermectin treatment continues now in only two foci that comprise the SIZ known as the Yanomami Areas. The strategy for the final elimination push in the Americas is to provide the Yanomami with quarterly MDA (every three months) in as many places as logistically possible. The Venezuela MOH has begun an effort to rehabilitate old landing strips to improve access to provide these remote populations with both quarterly MDA and improved overall healthcare.

2016 GENERAL RECOMMENDATIONS FOR THE CARTER CENTER RIVER BLINDNESS ELIMINATION PROGRAM

In collaboration with the host governments, RBEP helps interrupt onchocerciasis transmission in Carter Center-assisted River Blindness Elimination Program (TCC/RBEP) assisted areas in Africa by 2020. This includes:

- Helping to empower national onchocerciasis committees to review their data and make decisions related to enhancing interventions, expanding treatment, stopping interventions, and entering into post treatment surveillance, guided by (but not restricted to) WHO guidelines.
- Conducting new assessments to help delimit the precise borders of African onchocerciasis transmission zones ('*foci*') that are targeted for elimination in TCC/RBEP assisted areas.
- Defining areas of active onchocerciasis transmission, including within the so-called 'hypoendemic' onchocerciasis areas that have traditionally not been targeted for ivermectin treatment under previous WHO/APOC disease control policy.
- Enhancing interventions (two or four-times-per-year ivermectin treatment, vector control, etc.) where transmission persists or in new foci where treatments have never been given.
- Where active onchocerciasis transmission spans borders, working with authorities on both sides of internal or international boundaries to establish 'Special Intervention Zones' (SIZs) and the needed collaboration on both sides stop transmission.
- Monitoring the impact of interventions using sensitive tools.

Encourage the concerned Ministries of Health and local authorities to evaluate and treat cross- border foci in a coordinated manner.

Encourage the Ministries of Health to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Encourage the Ministries of Health to write a letter to the WHO Regional Director to address drug supply delays.

Improve collaboration among implementers, regarding drug supply delays and raise the issue to relevant stakeholders.

Programs should collect more information, to share at the next review, on communities with low coverage.

The Carter Center field offices should conduct treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible; timely drugs are critical, particularly for twice-per-year treatment areas. Programs in Africa should target March 31 submission rather than August 31 in order for application to be considered by the April WHO AFRO RPRG meeting (this body currently convenes in April and September). Drug inventories submitted with applications can be interim but should be updated as soon as possible. Assist the national programs with submissions. Keep TCC/RBEP headquarters informed on the process.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people, 1 community supervisor:5 CDDs and 1 community supervisor per village.

Carter Center website will house key documents from Elimination Committees (Ethiopia, Nigeria, Uganda).

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of South Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples and/or data to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation at the local level to help maintain program visibility and support wherever possible.

Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Evaluate technological solutions for improving accuracy and speed of village level data reporting.

The river blindness (RB), lymphatic filariasis (LF), schistosomiasis (SCH) and soil transmitted helminthiasis (STH) propose to assist ministries of health to provide 89,978,265 treatments in 2016. Overall treatment and training objectives follow:

UTG = Ultimate Treatment Goal
UTG(2) = Twice-per-year Ultimate Treatment Goal
UTG(4) = Four-times-per-year Ultimate Treatment Goal

River Blindness	
Quarterly UTG(4)	**84,852**
Semiannual UTG(2)	**24,592,998**
Annual UTG	**18,317,211**
CDDs	**285,585**
Community Supervisors	**59,165**

Schistosomiasis/STHs	
Annual UTG SCH	**4,922,191**
Annual UTG STH	**9,052,338**
Semiannual UTG(2) STH	**2,156,448**
CDDs	**17,730**
Community Supervisors	**7,277**

Lymphatic Filariasis	
Annual UTG	**20,901,695**
Semiannual UTG(2)	**9,950,532**
CDDs	**51,078**
Community Supervisors	**10,377**

ONCHOCERCIASIS ELIMINATION PROGRAM FOR THE AMERICAS (OEPA)

Summary

The primary strategy for eliminating onchocerciasis from the Americas is Mectizan® (ivermectin) MDA every 3-6 months, with health education and community mobilization, in all affected communities of the 13 endemic foci in the six affected countries. MDA aims to achieve at least 85% coverage of the population at risk and eligible for treatment. MDA has decreased by over 95% in the Americas since its peak in 2005 under this elimination strategy, as transmission in the region has been broken focus by focus (Figure O1). As of 2015, *O. volvulus* transmission was interrupted or eliminated in 11 of the 13 foci in the Americas, and in four of the six endemic countries. In 2015 Mexico became the third country verified by WHO (after Colombia in 2013 and Ecuador in 2014) as having eliminated onchocerciasis. A total of 60,971 Mectizan® treatments were given in 2015, all in the 'Yanomami Area' Special Intervention Zone (SIZ) on the border between Brazil and Venezuela (Figure ES16). The Yanomami Area is the last active transmission zone for onchocerciasis in the Americas and the only area that will be under treatment in 2016.

The Onchocerciasis Elimination Program for the Americas (OEPA) is a Carter Center-led program that serves as the vanguard of the regional initiative working to eliminate transmission of onchocerciasis from the Americas through distribution of Mectizan®. Mass Drug Administration (MDA) aims at reaching ≥85% coverage of the population eligible for treatment. In addition to The Carter Center, the OEPA coalition includes ministries of health (MOHs) of the six currently or formerly endemic countries = in the Americas (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela), the Pan American Health Organization/World Health Organization (PAHO/WHO), the United States Agency for International Development (USAID), the Carlos Slim Foundation, the Lions Clubs International Foundation (LCIF) and local Lions Clubs, the Bill & Melinda Gates Foundation, Merck and the Mectizan® Donation Program (MDP), the U.S. Centers for Disease Control and Prevention (CDC), and several U.S. and Latin American universities. A Program Coordinating Committee (PCC) serves as the steering committee for OEPA staff, which is based in Guatemala City, Guatemala. Technical and financial assistance to the six countries flows through the OEPA office.

The OEPA initiative was launched by the River Blindness Foundation (RBF) in 1993 in response to the 1991 Resolution XIV of the 35th PAHO Assembly that called for the elimination of onchocerciasis morbidity from the Americas by the year 2007. With the closure of the RBF in 1996, The Carter Center assumed administrative responsibilities for OEPA. In 2008, PAHO renewed the call to eliminate onchocerciasis (Resolution CD48.R12) throughout the region. A subsequent 2009 PAHO Resolution (CD49.R19), calling for the elimination or drastic reduction of 12 neglected infectious diseases of poverty in the Americas, includes onchocerciasis as an elimination target.

In 2001, the WHO established a set of guidelines to assist onchocerciasis programs to determine whether interruption of transmission had occurred and MDA with Mectizan®

could be stopped. These guidelines were revised in 2016 (See Executive Summary and Figure ES3). Once all transmission zones (foci) in a country reach the elimination stage, final country verification can be requested from independent international verification team (IVT) working under the auspices of the WHO. IVT activities involve a country visit.

Figure ES16 shows the situation in the Americas at the end of 2015. The regional population in onchocerciasis endemic and formerly endemic communities is 568,052, with 442,950 (78.0%) no longer at risk of infection. Of the 123,192 still at risk, most (77%) reside in the Northeast focus of Venezuela, where MDA has been discontinued. The post treatment surveillance assessments for this focus will not be completed until the end of 2016. The remaining 5.2% of the regional population at risk are 29,535 indigenous Yanomami people who live deep in the Amazon rainforest in an active transmission zone (known as the 'Yanomami Area') that straddles the border of Venezuela and Brazil.

Figure O1 shows the dramatic scale up and 95% scale down of treatments as the WHO 'roadmap' to elimination has been implemented. Note in the figure the switch from twice-per-year to four-times-per-year treatments in the final 'end-game' efforts in the Yanomami Area.

Venezuela/Brazil:

Two national foci, the Venezuelan South Focus and the Brazilian Amazonas Focus, comprise the Yanomami Area. The epidemiological map of the Yanomami Area and tables with details of Venezuela and Brazil treatment figures are provided in (Figures O2, O3, O4, and O5). Selected communities having the highest baseline infection prevalence (of microfilariae in skin) have been targeted to receive four-times-per-year ivermectin treatment in an effort to hasten the elimination of the disease (Figure O3). A total of 44,704 treatments were provided under this treatment strategy in 2015. However, because of challenges with accessibility, none of the 2015 quarterly rounds reached the > 85% goal. In 2015, 16,267 twice-per-year treatments were given in in less highly endemic communities, of which 91% coverage of the eligible population was achieved in the first round, and 93% in the second. In 2016, 21,213 individuals are being targeted for quarterly treatment and 3,605 individuals should be treated twice-per-year.

Mexico:

In November 2014, Mexico filed a formal application to WHO for verification after the Ministry of Health of Mexico and the OEPA technical steering committee (the Program Coordinating Committee-PCC) concluded that the country had eliminated onchocerciasis. The application included a comprehensive country dossier describing the history and achievements of the national program. The dossier started with the discovery of the first cases in 1923, in southern Chiapas State. The Mexican Onchocerciasis Program was launched in 1930, making it the longest continuously

operative onchocerciasis program in the Americas (85 years). It is also the only American onchocerciasis program having a cadre of health workers devoted exclusively to onchocerciasis control/elimination. There were three Mexican onchocerciasis transmission foci: Oaxaca, North Chiapas and South Chiapas. Residing in these foci was the second largest population (nearly 170,000 individuals in 670 communities) at risk for onchocerciasis in the Americas (after Guatemala). During the first 60 years the program strategy focused on surgical removal of nodules, treatment with cases with diethylcarbamazine (DEC), and sporadic vector control. Ivermectin MDA began in 1990. The North Chiapas focus completed 26 rounds of ivermectin MDA from 1995-2007, with 17 (65%) of those rounds having coverage >85%. North Chiapas was the first to halt MDA, and successfully completed its PTS phase in 2010. The Oaxaca Focus completed 28 rounds of treatment with ivermectin from 1995-2008, with 18 (64%) of those rounds having coverage ≥85%. Oaxaca successfully completed PTS in 2011. South Chiapas was the largest Mexican focus with the most intense onchocerciasis transmission, and took the longest to eliminate. It required 34 rounds of MDA from 1995-2011 with 25 (74%) of those rounds having coverage > 85%. The South Chiapas Focus was a pioneer in the implementation of four-times-per-year (quarterly) treatment in selected communities where twice-per-year treatment appeared to be insufficient to break transmission. Four-times-per-year treatment started in 2003 in 50 communities (5,824 at risk) and eventually expanded to 163 communities (33,269 at risk) by 2011.

In response to Mexico's dossier and request, an International Verification Team (IVT) visited the country from June 1-10, 2015, to extensively review the program and data supportive of elimination with respect to the WHO 2001 guidelines. On July 29, 2015, based on the internal review of the IVT's report at WHO Geneva, the Director-General issued an official letter to Mexico confirming the elimination of onchocerciasis transmission. The Secretary of Health of Mexico announced the WHO verification in a celebratory event held on 29 September 2015 tied to the meeting of the 54th Directing Council of PAHO (Figure O6). It is notable that over 90% of the costs (excluding the value of the donated ivermectin) of the 1999 to 2014 MDA-based elimination campaign were borne by the Government of Mexico, with the rest provided by external donors.

Guatemala:

On March 20, 2015, Guatemala filed a formal application to WHO for verification of onchocerciasis elimination after the Ministry of Health of Guatemala and the PCC concluded that the country had eliminated onchocerciasis transmission. The application included a comprehensive country dossier describing the history and achievements of the national program. In response to Guatemala's request, an IVT visited the country from May 30 to June 10, 2016, to extensively review the program and supportive evidence for elimination in accordance with WHO guidelines. The IVT delivered its report to the PAHO's country representative on June 10, 2016. [Editor's note: The decision from WHO on the IVT's report is pending as of the publication date of the Proceedings.]

The 25th Annual Interamerican Conference on Onchocerciasis (IACO'15) in Antigua, Guatemala

The 25th IACO took place in Antigua, Guatemala from November 18-19, 2015 (Figure O7). The meeting was opened by Mr. Mariano Rayo Muñoz, Guatemala's Minister of Public Health and Welfare. In recognition of the 100th anniversary of the discovery of river blindness in the Americas in 1915 by Guatemalan physician Dr. Rodolfo Robles, the meeting's theme was, "A century from discovery to elimination: Winning the fight against onchocerciasis in Guatemala and the Americas." Guatemala's postal service even released a commemorative stamp, picturing Dr. Robles, to celebrate the elimination of onchocerciasis from the country (Figure O8).

This year's attendance at IACO was expanded beyond the experts and partners from the Americas to include delegations from Ethiopia, Nigeria and Uganda. As more and more countries in Africa officially declare onchocerciasis elimination policies, IACO provided a very fruitful – and mutually beneficial – opportunity to exchange elimination experiences.

2016 RECOMMENDATIONS FOR THE ONCHOCERCIASIS ELIMINATION PROGRAM FOR THE AMERICAS (OEPA)

Promote identification of all as yet unknown Yanomami communities in the South Venezuela Focus (Yanomami Area) by the end of 2016.

Continue the implementation of four-times-per-year treatment, prioritizing hyper-endemic areas. High treatment coverage (>85%) in each of four treatment rounds should be considered priority in villages 'scored' by a series of factors such as: year when treatment began, the number of rounds with any treatment coverage, the number of rounds with>85% treatment coverage, and the number of consecutive rounds of >85% coverage, baseline endemicity, and the efficiency of the vector in the area.

Promote the highest level of political support from Venezuela and Brazil for the elimination of onchocerciasis from the Yanomami Area, including support for the 2014 binational memorandum of agreement (MOA) which calls for an annual bi-national plan of operations and an annual meeting of the binational steering committee.

Advocate for and support a 2016 meeting of the Brazil-Venezuela bi-national committee, with OEPA representation.

Focus on launching programmatic activities in the Siapa river valley in Venezuela.

Solve transportation issues in hard-to-reach communities on the border of Venezuela and Brazil. Support efforts to recover old landing strips in Venezuela. Continue to consider cross border flights from Brazil into Venezuela (especially for the Siapa valley).

Collaborate with PAHO to develop a new resolution for the elimination of onchocerciasis in the region by a certain date. That resolution should mention OEPA.

Assist Guatemala to prepare for the visit by the WHO verification team scheduled for May-June 2016.

Continue to invite all countries to IACO regardless of verification of elimination status.

Encourage the Lions Clubs International Foundation to support the attendance of a Lions representative from each of the six countries to IACO.

Complete PTS in 2016 in the Northeast focus of Venezuela.

2016 Treatment Objectives:

Onchocerciasis	
UTG(2):	**7,210**
UTG(4):	**84,852**

Figure O1

Mectizan® Treatments Distributed in the Americas
2x and 4x/Year Treatment Approaches
1989 - 2015

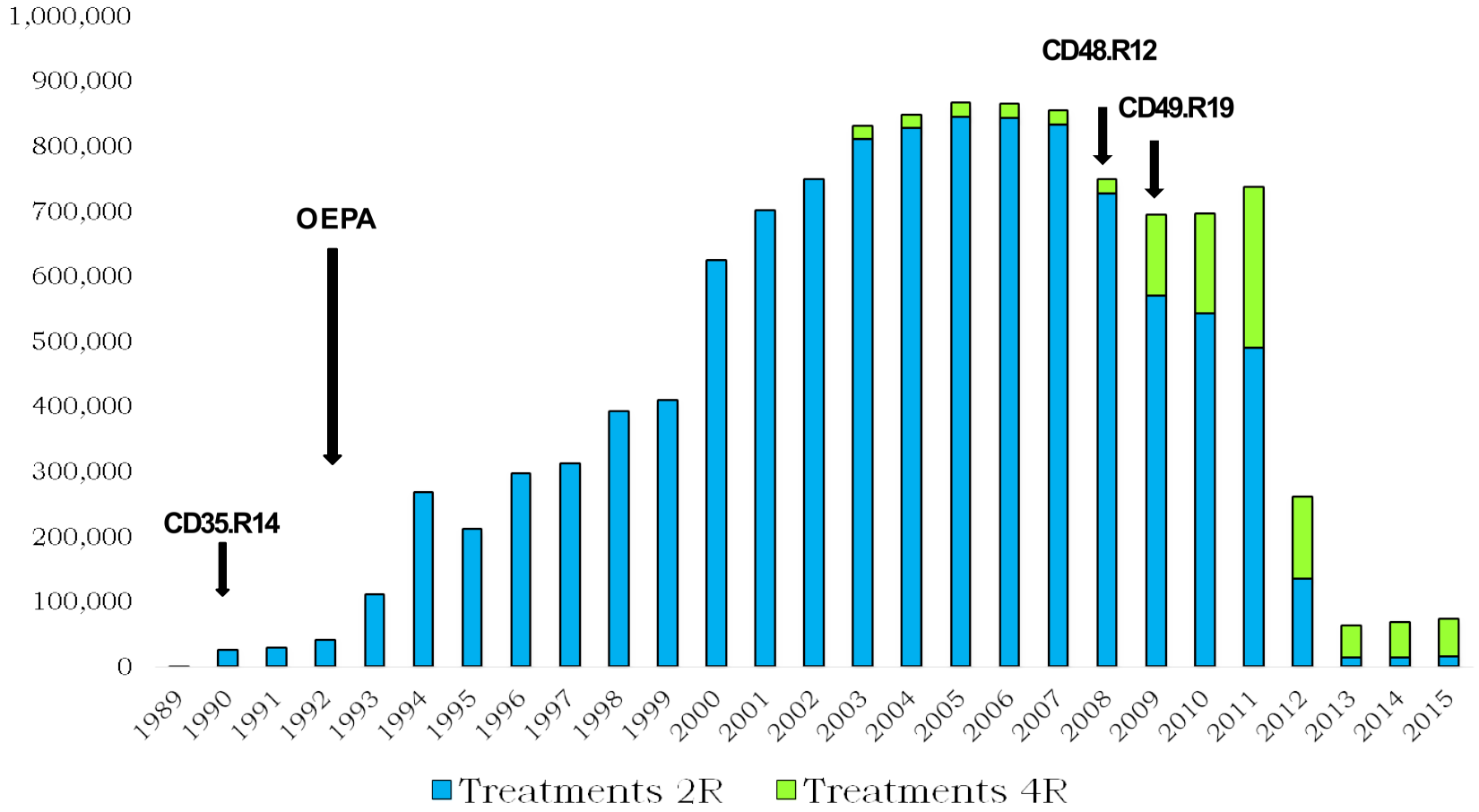


Figure O2

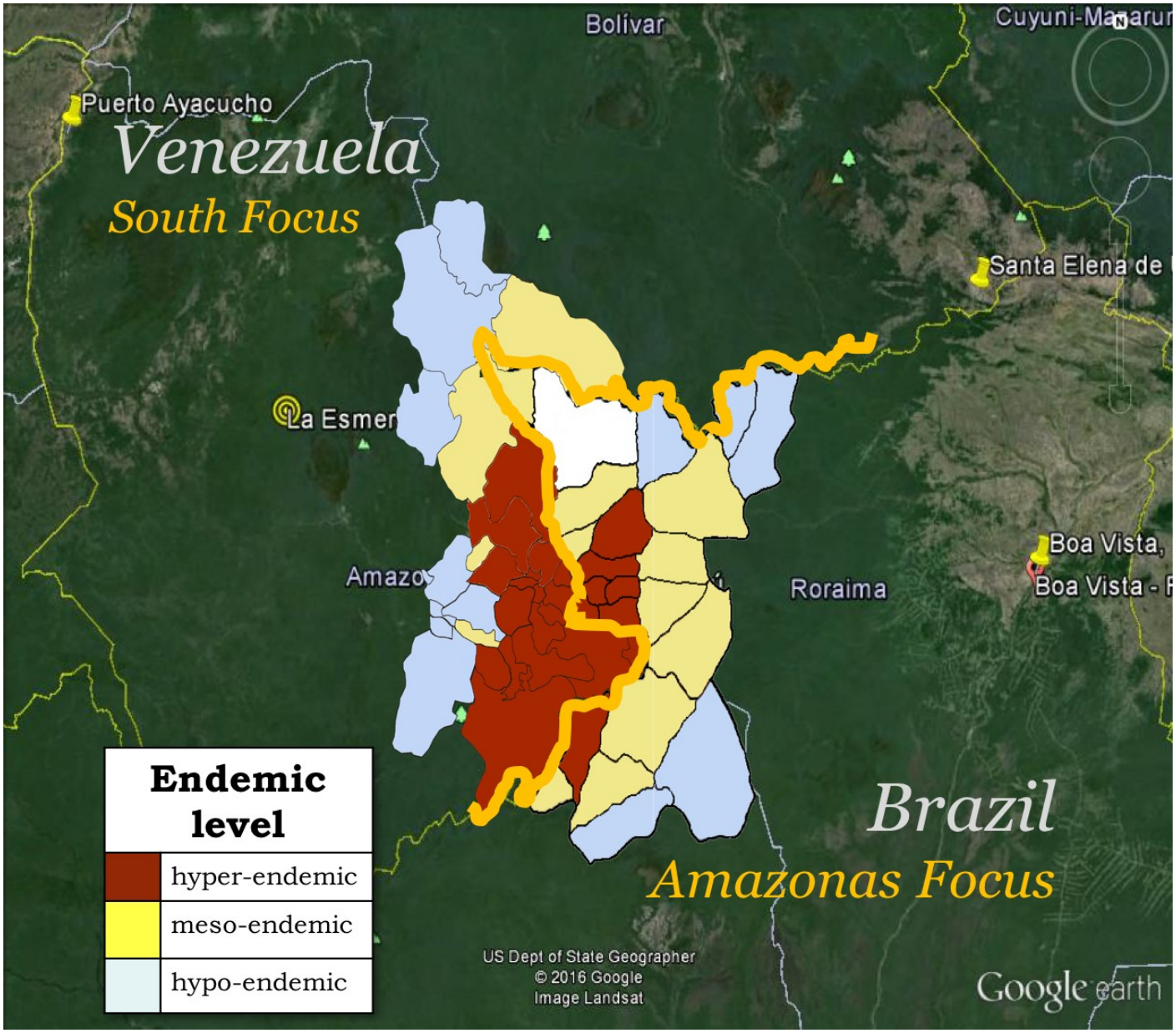

Bolívar
Cuyuni-Mazaruni
Puerto Ayacucho
Venezuela
South Focus
Santa Elena de
La Esmer
Amazo
Roraima
Boa Vista,
Boa Vista - R
Brazil
Amazonas Focus
Endemic level
hyper-endemic
meso-endemic
hypo-endemic
US Dept of State Geographer
© 2016 Google
Image Landsat
Google earth

Figure O3

OEPA Treatment Report in 2015

2x/ Year

Focus	Communities Treated 2x	Meso-Communities	Hypo-Communities	Pop at Risk 2x	Eligible for Treatment	Coverage 1st Rd	Coverage 2nd Rd	Coverage UTG2
						%	%	%
Amazonas-BRA	98	42	56	6,638	5,334	89	93	96
South-VEN	49		49	3,945	3,486	94	93	97
Total	**147**	**42**	**105**	**10583**	**8820**	91	93	97

4x/ Year

Focus	Communities Treated 4x	Hyper Communities	Meso Communities	Pop at Risk 4x	Coverage 1st Rd	Coverage 2nd Rd	Coverage 3rd Rd	Coverage 4th Rd	UTG4	Coverage UTG4
					%	%	%	%		%
Amazonas-BRA	121	101	20	7,756	70	80	82	85	**25,564**	80
South-VEN	192	167	25	9,286	78	81	76	71	**31,880**	76
Total	**313**	**268**	**45**	**17042**	74	81	79	77	**57,444**	**78**

Figure O4

Venezuelan South Focus

2015	
Geographic Areas	10
Geographic Sub-areas	31
Population at Risk	13,231
Population Eligible for Treatment	11,456

Communities 2015	
Total	241
Hyper-endemic	167
Meso-endemic	25
Hypo-endemic	49
4x/year	192
2x/year	49

Communities by Treatment Approach 2003-2015

Year	2x/year	4x/year	Communities (2x/year + 4x/year)
2003	115		115
2004	115		115
2005	115		115
2006	115		115
2007	131		131
2008	131		131
2009	116	45	161
2010	95	66	161
2011	44	135	179
2012	42	143	185
2013	45	160	205
2014	45	179	224
2015	49	192	241

Figure O5

Brazilian Amazonas Focus

2015	
Geographic Areas	**22**
Population at Risk	**14,394**
Population Eligible for Treatment	**11,725**
Communities 2015	
Total	**219**
Hyper-endemic	**101**
Meso-endemic	**62**
Hypo-endemic	**56**
4x/Year	**121**
2x/Year	**98**

Geographic Areas and Communities By Treatment Approach 2003-2015

Year	Geographic Areas			Communities		
	2x/year	4x/year	Total	2x/year	4x/year	Total
2003	18		18	191		191
2004	18		18	219		219
2005	18		18	219		219
2006	18		18	187		187
2007	18		18	188		188
2008	18		18	189		189
2009	22		22	187		187
2010	19	3	22	152	41	193
2011	12	10	22	81	112	193
2012	12	10	22	86	114	200
2013	12	10	22	93	117	210
2014	12	10	22	98	120	218
2015	12	10	22	98	121	219

Figure O6

OEPA Celebratory Event (29 September 2015) at the Meeting of the 54th Directing Council of PAHO

Photo Left: (L-R) Dr. M. Chan (Director General WHO), Dr. C. Etienne (Director PAHO), Dr. J Gerberding (Merck), Ambassador (ret) MA. Peters (CEO The Carter Center) Dr. Carina Vance (Minister of Ecuador), Fernando Ruiz Gómez (Vice Minister of Colombia), Dr. M Chan (Director General WHO), Pablo Kuri (Subsecretary of Health in Mexico), Dr. Carlisse Etienne (Director PAHO), Dr. J Gerberding (Merck), Brazil representative, Claudia Moron, (Vice Minister of Venezuela), Ambassador (ret) MA Peters (CEO The Carter Center)

Photo Right: (L-R) Ambassador (ret) MA. Peters (CEO The Carter Center), Dr. M. Chan (Director General WHO), Dr. C. Etienne (Director PAHO), Dr. J Gerberding (Merck)

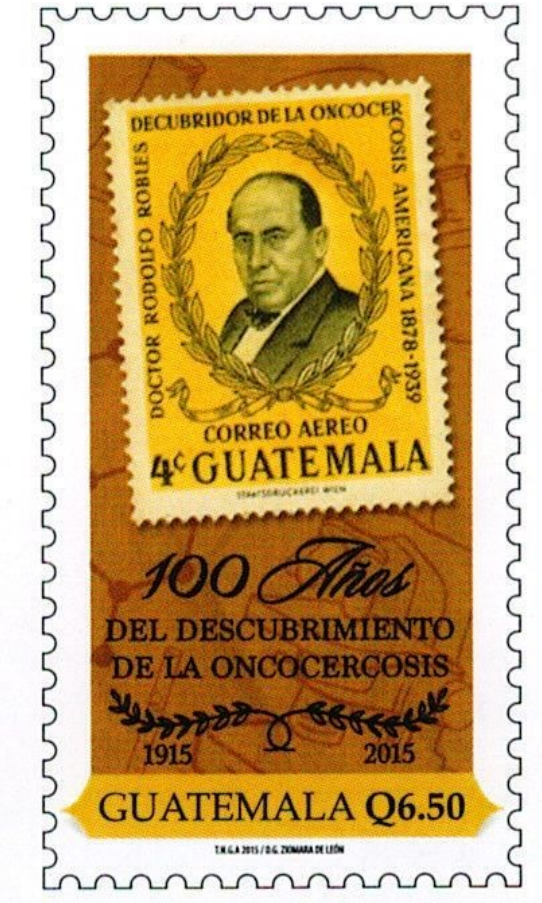
Figure O7

2015 InterAmerican Conference on Onchocerciasis

Above: OEPA Director, Dr. Mauricio Sauerbrey with WHO NTD Director, Dr. Dirk Engles

Figure O8

Guatemala Postal Service's 2015 Commemorative Stamp



In honor of Dr. Rodolfo Robles V., who discovered Onchocerciasis in the Region of the Americas in 1915

UGANDA

Summary

Since the launching of its onchocerciasis elimination program in 2007, Uganda has interrupted transmission of onchocerciasis in 10 of the 17 foci (Figures U1 and ES13). This translates into about 1.7 million treatments for onchocerciasis no longer being required in Uganda.

The major challenge is to attain a desired treatment coverage of at least 90% of the ultimate treatment goal (UTG) in large Madi-Mid North focus districts that were recently pacified after years of insurgency. Most communities in this focus currently utilize their traditional structure of "Rwot Kweri" to promote health education, selection and training of Community Directed Distributors (CDDs) and community supervisors (CSs). Communities that use this method have successfully reached the desired coverage. Once this method has been instituted throughout the Madi-Mid North focus, it's believed better coverage will be attained.

Uganda has three foci (Bwindi, Nyagak-Bondo and West Nile) where interruption of transmission is suspected but there is uncertainty due to shared international borders with DRC. Interventions cannot be halted unless the RB transmission status across the border is known. In 2015, the Uganda Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) recommended that the Ministry of Health work with the DRC to conduct joint cross-border assessments, and to provide a report of their findings at the 2016 UOEEAC meeting. If this model is successful, it could offer a way forward in other foci with possible ongoing cross border transmission such as Lhubiriha and Madi-Mid North.

Background: Onchocerciasis affects 36 of the 112 districts in Uganda (Figure U1). The first Ugandan onchocerciasis transmission zone ('focus') to successfully eliminate the disease was Victoria, which claimed victory in the 1970s following a vector control campaign based on DDT spraying of rivers that liberated at least three people from the vector of the disease. Onchocerciasis control using annual mass treatment with Mectizan® began in 1991. The original Ministry of Health ivermectin program received financial support from The River Blindness Foundation (RBF), CBM, and Sightsavers. In 1996, The Carter Center (TCC) assumed the activities of RBF. In 1997, the African Program for Onchocerciasis Control (APOC) began supporting some Ugandan efforts and introduced the community-directed approach to Mectizan® distribution. APOC also supported successful vector elimination efforts in two foci (Itwara and Mpamba-Nkusi) that used ground larviciding with temephos (Abate®) together with annual Mectizan® distribution. In 2006, The Lions-Carter Center partnership helped launch semi-annual treatments (every six months) to eliminate onchocerciasis from the Wadelai focus, with support from Merck (funding being administered through the NGDO Coalition for Onchocerciasis Control). Wadelai's success was confirmed in 2010, but annual treatment with Mectizan and albendazole had to continue as the Nebbi district is also endemic for LF (Figure U7).

The Uganda Ministry of Health (MOH) was emboldened by their elimination successes, and announced a nationwide elimination policy in 2007 that was to be based on twice-per-year treatment (where necessary) and (where feasible) vector elimination/control (using ground-based larviciding), in addition to health education in the affected communities. The new flexible elimination policy, which aimed for nationwide elimination of onchocerciasis by the year 2020, was immediately applauded and supported technically and financially by the Lions-Carter Center partnership and Sightsavers.

Currently, onchocerciasis elimination in Uganda is supported by The Carter Center, the United States Agency for International Development (USAID) ENVISION project led by RTI International, and Sightsavers, under the coordination of the Ministry of Health. The Carter Center River Blindness Elimination Program (RBEP) assists in all 36 of the onchocerciasis endemic districts.[1] In Koboko and Yumbe districts, the assistance has been mainly in mapping, parasitological, entomological and serological assessments. Since 2007, The Carter Center has supported technical services, vector elimination activities and some community-directed treatment with ivermectin (CDTI) activities in Buliisa, Kibale, Hoima, and Masindi, in partnership with Sightsavers, which operationally supports these districts. The Carter Center has also supported technical services in the districts of Kabarole and Kyenjojo in the Itwara focus. Ivermectin distribution through CDTI in the West Nile focus is supported by the Ministry of Health of Uganda and ENVISION. APOC which used to support many of the other onchocerciasis endemic districts closed last December.

Lions have supported the Uganda effort through the Lions Clubs International Foundation (LCIF) SightFirst program for many years. LCIF's most recent grant began in August 2013. Ugandan Lions Clubs are very active participants in and advocates for the Carter Center-assisted river blindness elimination activities, including engaging and mobilizing members of parliament, district and other relevant government officials. The Carter Center's Country Representative in Uganda, Ms. Peace Habomugisha, is a Lions Club member.

Uganda laboratory activity: In support of the elimination effort, The Carter Center has continued to fund equipment and reagents for the MOH laboratory that provides state-of-the-art diagnostic support to the elimination program. The laboratory is located at the MOH Vector Control Division in Kampala and provides polymerase chain reaction

[1] 36 oncho endemic districts: Bushenyi, Kabale, Kanungu, Kasese, Kisoro, Rubirizi, Buhweju, Kamwenge, Ibanda, and Mitooma (in southwest Uganda); Buliisa, Hoima, Kabarole, Kibale, Kyenjojo, and Masindi (in western Uganda); Adjumani, Arua, Koboko, Maracha, Moyo, Nebbi, Yumbe, and Zombo (in the West Nile region bordering the Democratic Republic of the Congo); Amuru, Gulu, Kitgum, Lamwo, Lira, Nwoya, Oyam and Pader districts (in the Mid North focus); and Bududa, Manafwa, Mbale, and Sironko (in the Mount Elgon focus in the east, bordering Kenya).

(PCR) testing for black flies and skin snips, and serologic enzyme-linked immunosorbent assay (ELISA) testing for OV16 antibodies. Technical backup and reference lab support is provided by Dr. Thomas Unnasch's laboratory at the University of South Florida in Tampa, Florida. Since its launching, the Uganda laboratory has analyzed 101,536 samples. In 2015, the lab analyzed 16,603 blood spots for OV16 antibodies. It also analyzed 3,180 skin snips and 29,563 *Simulium* vector black flies by PCR and the PoolScreen® program.

Expert Advisory Committee for National Onchocerciasis Elimination: To ensure that the elimination decisions are supported with the best scientific and technical advice, the Uganda MOH established the Ugandan Onchocerciasis Elimination Expert Advisory Committee (UOEEAC), which is currently chaired by Dr. Thomas Unnasch (University of South Florida). The UOEEAC meetings are supported financially by The Carter Center. UOEEAC responsibilities are to: 1) review programmatic activity reports from each elimination-targeted focus in Uganda annually; 2) advise the MOH on focus-specific monitoring and evaluation activities, and recommend halting of interventions when appropriate in accord with international and national guidelines; and 3) make any other recommendations to the MOH on activities needed to reach the national 2020 elimination goal. In addition to MOH and institutional representatives the UOEEAC includes several members-at-large who are recognized for their international expertise in onchocerciasis. One of these, Dr. Tom Unnasch of the University of South Florida, is chair of the committee. Mr. Tom Lakwo (National Coordinator for the onchocerciasis elimination program, MOH) and Ms. Peace Habomugisha (The Carter Center country representative) both serve as committee secretaries. The World Health Organization (WHO) Uganda representative attends these meetings as an observer, to avoid any conflict of interest since WHO will coordinate the future international verification team visit.

Since its inception, the UOEEAC has designated 10 foci where onchocerciasis transmission has been interrupted (see U1 for corresponding numbers of foci): 1. Wadelai in 2010; 2. Mt. Elgon and 3. Itwara in 2011; 4. Mpamba-Nkusi, 5. Imaramagambo, 6. Maracha-Terego in 2012; 7. Kashoya-Kitomi 8. Wambabya-Rwamarongo in 2013, 9. Obongi in 2014, and 10. Nyamugasni in 2015 (Figure 5). This translates into about 1.7 million treatments for onchocerciasis no longer being required in Uganda.

At its eighth session (August 3-5, 2015) the UOEEAC recommended in 2016 there be final evaluations of six foci completing their three-year post-treatment surveillance (PTS) monitoring periods (Mt. Elgon, Kashoya-Kitomi, Imaramagambo, Itwara, Mpamba-Nkusi and Wambabya-Rwamarongo). UOEEAC recommended that these evaluations include both entomological and serological assessments (among children under 10 years of age). The committee noted that the LF transmission assessment survey (TAS) in Wadelai was soon to take place. If the TAS determined that LF MDA could halt, Wadelai could enter its three-year PTS stage.

Treatments: The Carter Center-assisted treatments achieved 89% of the 2015 treatment target of 3,791,145.

The Ultimate Treatment Goal (UTG) for Carter Center-assisted areas annual ivermectin treatment was 10,237 in 2015, and achieved 87% coverage (8,884 treatments provided). In the areas targeted for twice-per-year treatment, the 2015 UTG(2) was 3,780,908 and the program provided 3,370,349 treatments, 89% coverage (Figures U3 and U4). In total, the Uganda RBEP assisted in a total of 3,379,233 mass treatments in 2015 (as well as 145,440 passive and visitor treatments). The Uganda RBEP reached 100% of all villages targeted for treatment. The program continues to develop its implementation process in order to overcome the challenges being experienced in 5 districts of the expansion areas of the Madi-Mid North focus where coverage was lowest (Gulu 76%, Amuru 78%, Kitgum 79%, and Lira 88%) (Figure U4). The Uganda program will provide semiannual treatments to all districts in 2016.

Training and Health Education: Uganda trained or retrained 31,419 Community-Directed Distributors (CDDs) and 8,151 Community-Directed Health Supervisors (CDHSs) in 2015. Of those trained in 2015, 40% of the CDDs and 29% of the CDHSs were female. The current ratio of CDDs to population served is 1 CDD to 73 persons served, and the supervisor-to-CDD ratio was 1:4.

Financial Contribution: Figure U6 shows APOC (which closed in 2015), Carter Center with its major donors (LCIF, and USAID's ENVISION Project), and government (district and national) financial contributions to onchocerciasis control/elimination in areas assisted by the RBEP. Starting in 2007, The Carter Center dramatically increased its funding with the launching of the new national elimination policy; APOC support remained relatively stable (US $103,641). The national government contribution reduced from US $51,195 in 2014 to US$ 28,359 in 2015.

Sustainability and Integration: The RBEP-assisted CDTI program actively co-implements with the national lymphatic filariasis elimination effort, which reached 1,181,708 persons in the Carter Center assisted districts. Low LF coverage was observed in Gulu and Kitgum (Figure U7).

Co-implementation with the Vitamin A Supplementation (VAS) Program for young children (6-59 months) was done with Carter Center assistance in Kabale and Kanungu districts. In the first round, 8,175 children were treated at 20.3% treatment coverage; and in the second round 18,348 children were treated, at 45.5%. The low coverage was due to an inadequate supply of Vitamin A. The chronic shortage of Vitamin A did not allow extension of VAS to other districts.

2016 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, UGANDA

Intensify CDTI activities in the Madi-Mid North onchocerciasis focus particularly Amuru, Gulu, Kitgum, Lira and Oyam districts, with the aim of improving community involvement, and treatment coverage (at least 90% of UTG) in each treatment cycle every year. A special presentation on this focus will be requested at the next program review.

Continue re-orienting the CDTI activities in Madi/Mid North focus to the Rwot Kweri structure in order to boost treatment coverage in Amuru, Gulu, Kitgum, Lira and Oyam districts.

Provide financial and administrative support for the 2016 UOEEAC meeting.

Recommend that the MOH work with DRC to conduct joint Special Intervention Zone (SIZ) cross-border activities with the western Ugandan foci, and to provide a report of such activities at the 2016 UOEEAC.

Complete final post treatment surveillance (PTS) evaluations in the six foci where treatment has been halted and report results at the 2016 UOEEAC.

Publish Uganda country experience with onchocerciasis elimination as well as the results of Uganda onchocerciasis elimination mathematical models (in collaboration with the University of Notre Dame).

Define Knowledge Attitude and Perceptions (KAP) in three PTS foci (Kashoya-Kitomi, Mt. Elgon, and Imaramagambo) regarding broad understanding of why MDA was halted and the elimination of onchocerciasis. The study will also determine what the CDDs in these foci are involved in now that onchocerciasis interventions were halted.

Commence the feasibility pilot study of vector control of *S. damnosum* in the Madi/Mid-North focus.

Overall Treatment Objectives for onchocerciasis for 2016:

River Blindness	
Semiannual UTG(2)	**3,894,298**
Passive (TX in Towns)	**246,190**

Training Objectives	
CDDs:	**22,410**
CSs:	**7,470**

Figure U1

Uganda's Progress Towards Elimination of Onchocerciasis: 2015

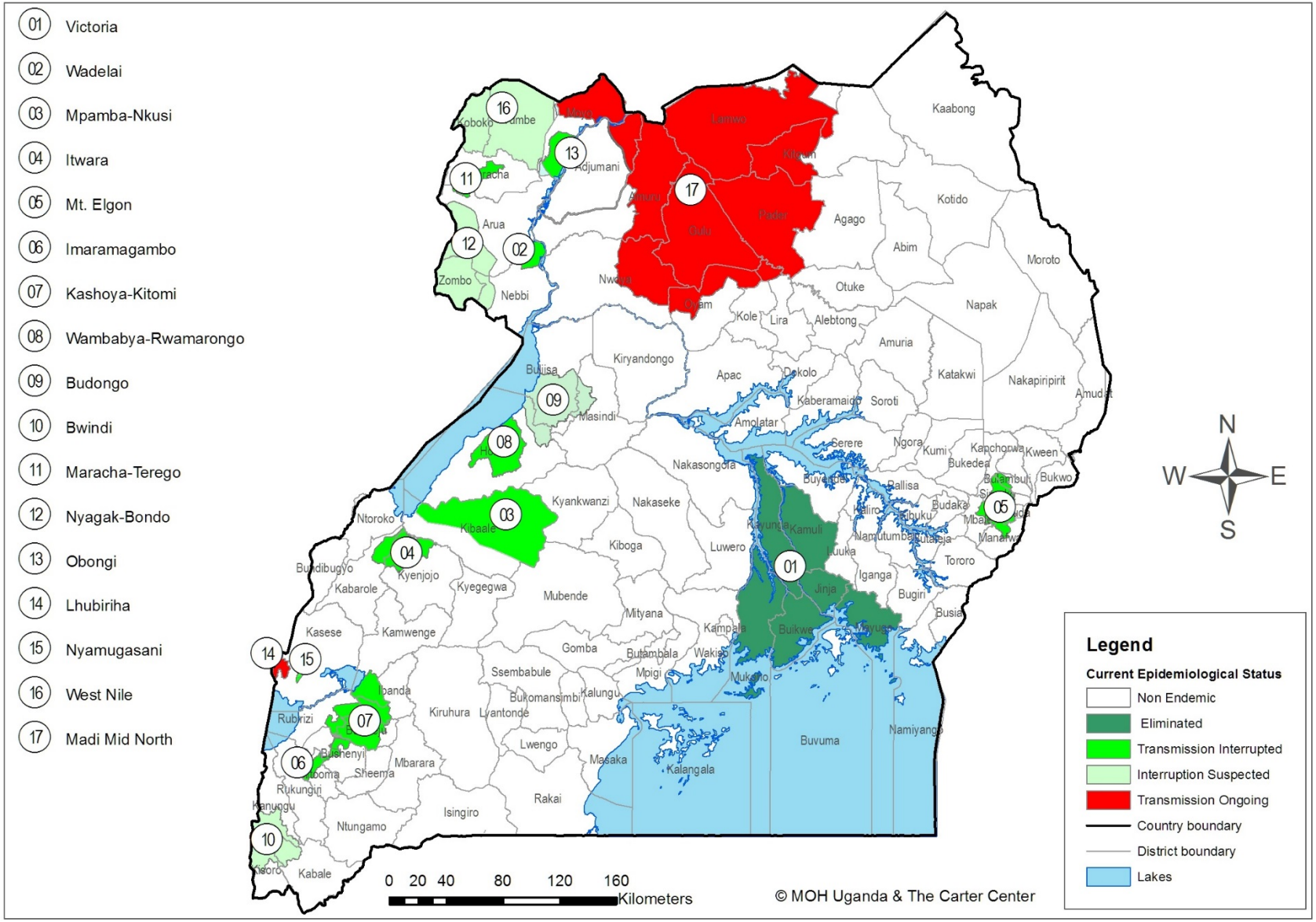
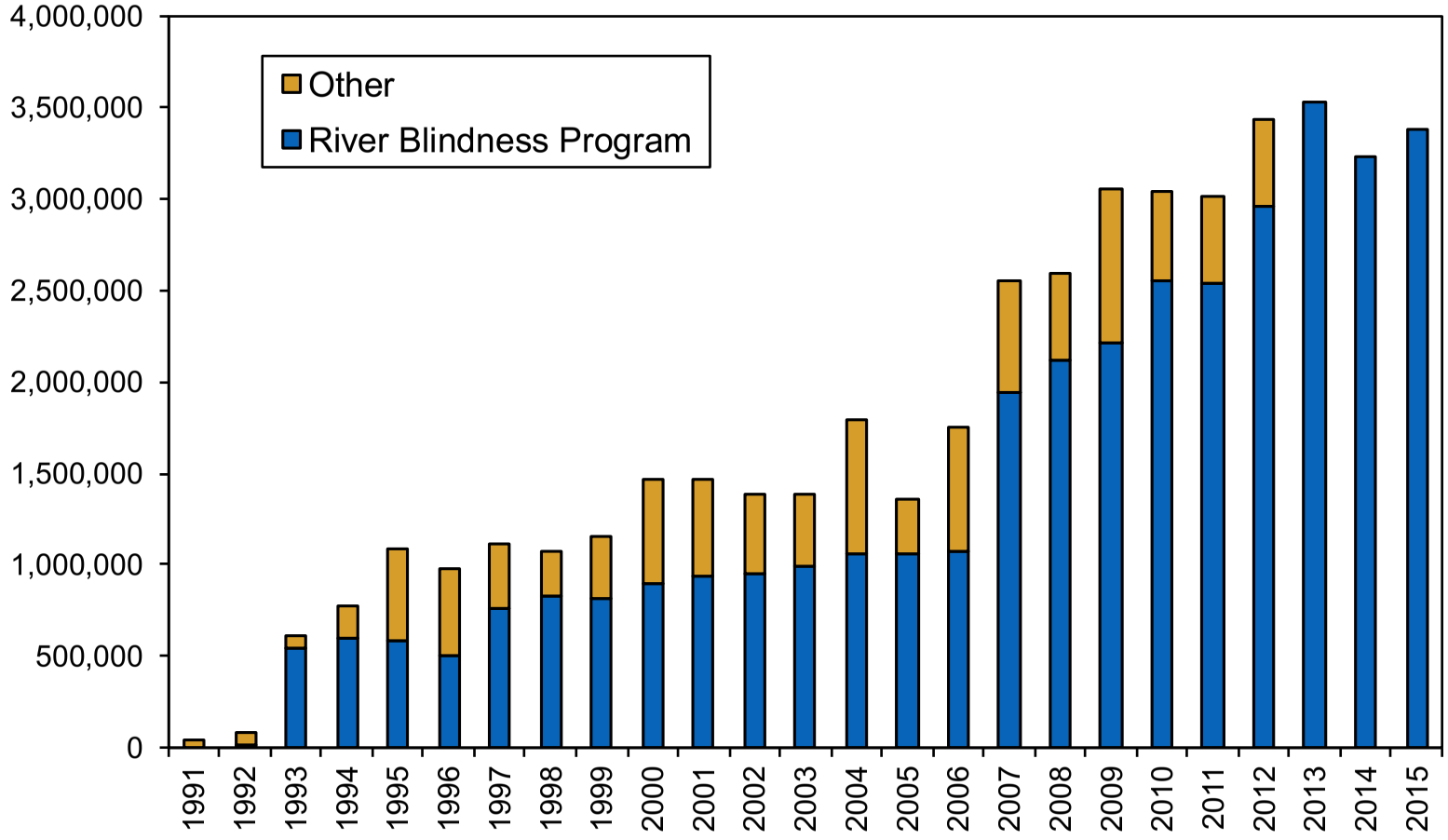


Figure U2

Uganda: Carter Center-Assisted Treatments and Total Mectizan® RB Treatments Provided, 1991-2015



*Treatments in 1992-1995 assisted by River Blindness Foundation.

Figure U3

Uganda - Transmission Interruption Suspected: 2015 Semiannual Treatments

Focus	District	Transmission Suspected (Year)	Total Population	UTG 1	UTG 2	Population Treated		Population Treated Cumulative	% Treatment Coverage Cumulative	Active Villages UTG	Active Villages % UTG
						RD1	RD2				
Budongo	Hoima	2014	77,782	64,362	128,724	62,497	62,595	125,092	97%	70	100%
	Masindi		32,403	28,010	56,020	27,224	27,969	55,193	99%	60	100%
	Buliisa		50,901	41,607	83,214	38,919	39,632	78,551	94%	54	100%
Bwindi	Kabale	2013	31,372	24,998	49,996	24,719	23,388	48,107	96%	58	100%
	Kanungu		60,483	48,971	97,942	45,283	45,793	91,076	93%	107	100%
	Kisoro		38,669	31,186	62,372	29,047	29,448	58,495	94%	45	100%
Nyagak Bondo	Nebbi	2014	133,414	108,779	217,558	102,076	102,261	204,337	94%	168	100%
	Zombo		237,626	196,219	392,438	189,806	190,434	380,240	97%	625	100%
	Arua		175,600	149,224	298,448	140,010	146,224	286,234	96%	325	100%
West Nile	Yumbe	2013	295,213	250,931	-	-	-	-	0%	248	100%
	Koboko		172,088	146,275	-	-	-	-	0%	394	100%
	Arua		142,205	120,874	-	-	-	-	0%	614	100%
Total			**1,447,756**	**1,211,436**	**1,386,712**	**659,581**	**667,744**	**1,327,325**	**96%**	**2,768**	**100%**

Figure U4

Uganda: Transmission Ongoing- 2015 Semiannual Treatments

Focus	District	Total Population	UTG 1	UTG 2	Population Treated		Population Treated Cumulative	% Treatment Coverage Cumulative	Active Villages UTG	Active Villages % UTG
					RD1	RD2				
Lhubiliha	Kasese	127,294	105,154	210,308	102,012	103,261	205,273	98%	124	100%
Madi Mid-North	Adjumani	26,948	22,253	44,506	32,121	20,251	42,372	95%	43	100%
	*Amuru	224,734	180,039	360,078	122,215	158,964	281,179	78%	67	100%
	*Gulu	325,791	276,144	552,288	200,104	218,286	418,390	76%	231	100%
	*Kitgum	101,579	85,419	170,838	69,440	65,634	135,074	79%	234	100%
	Lamwo	138,408	114,072	228,144	102,214	107,256	209,470	92%	427	100%
	*Lira	73,412	63,709	127,418	56,144	56,326	112,470	88%	225	100%
	Pader	170,689	141,890	283,780	123,797	137,096	260,893	92%	617	100%
	Moyo	85,520	74,657	149,314	66,850	70,559	137,409	92%	165	100%
	Nwoya	139,066	114,509	229,018	101,971	104,077	206,048	90%	54	100%
	Oyam	22,473	19,252	38,504	16,501	17,945	34,446	89%	35	100%
Total		**1,435,914**	**1,197,098**	**2,394,196**	**993,369**	**1,059,655**	**2,043,024**	**85%**	**2,222**	**100%**

*There was poor treatment coverage in Amuru, Gulu, Kitgum and Lira in 2015

Figure U5

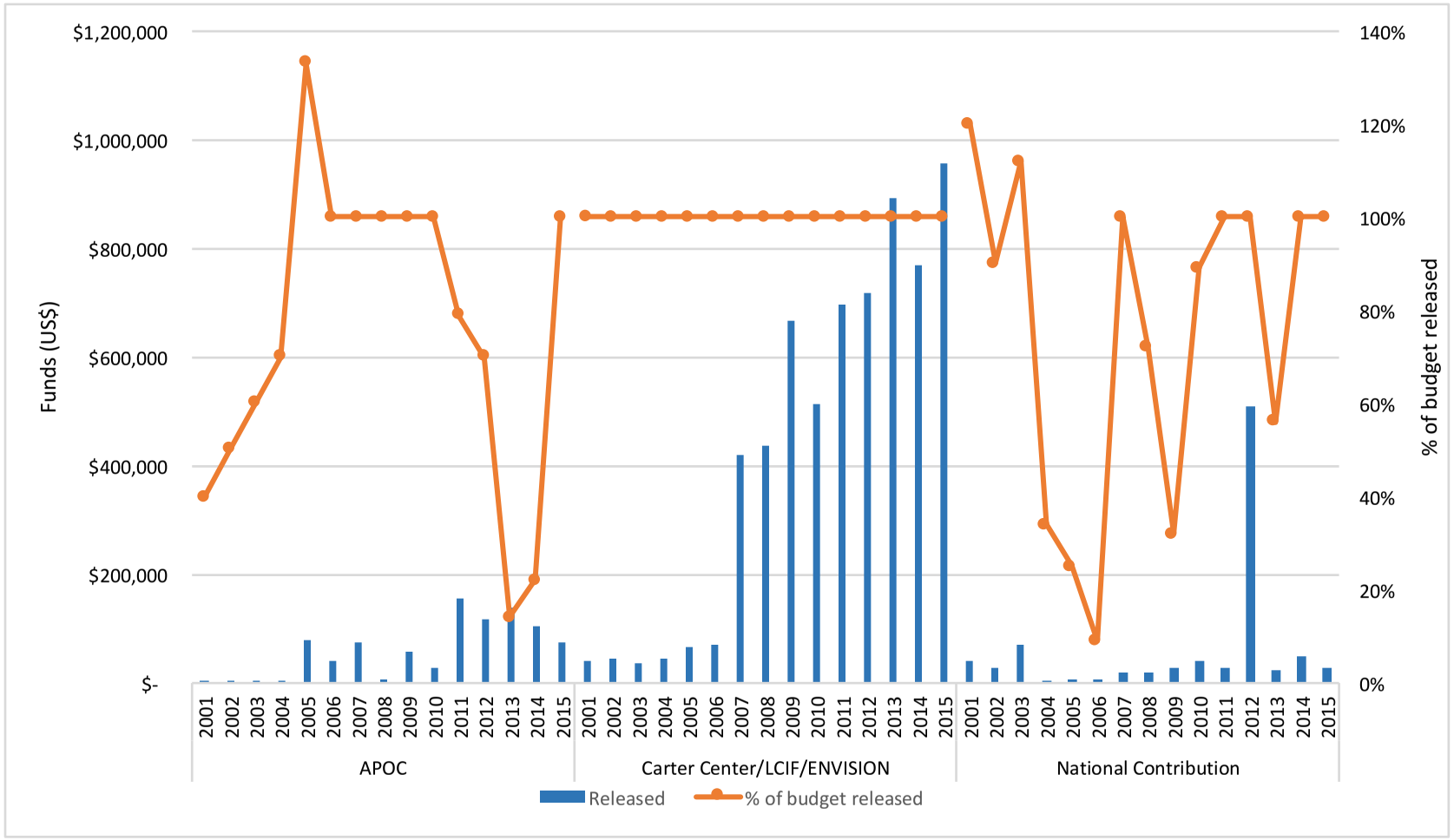
Uganda: Treatments where Onchocerciasis has been Interrupted (Dark Green) or is Suspected Interrupted (Light Green) 2015

ID #	Focus	District	Vector	# MDA Annual Rounds	# MDA Semi-Annual Rounds	Total Population	Projected Annual TXs	Projected Semi-Annual TXs	Status of Transmission
2	Wadelai	Nebbi*	*S.neavei*	15	8	17,979			Interrupted (2010)
3	Mpamba-Nkusi	Kibale	*S.neavei*	17	8	194,045			Interrupted (2012)
4	Itwara	Kabarole	*S.neavei*	20	2	32,875			Interrupted (2011)
		Kyenjojo		20	2	68,398			Interrupted (2011)
5	Mt.Elgon	Bududa	*S.neavei*	15	8	161,630			Interrupted (2011)
		Manafwa		15	8	40,604			Interrupted (2011)
		Mbale		15	8	50,253			Interrupted (2011)
		Sironko		15	8	76,375			Interrupted (2011)
6	Imaramagambo	Bushenyi	*S.neavei*	18	0	112,633			Interrupted (2012)
7	Kashoya-Kitomi	Buhweju	*S.neavei*	16	13	60,255			Interrupted (2013)
		Ibanda		16	13	26,144			Interrupted (2013)
		Kamwenge		18	13	45,626			Interrupted (2013)
		Rubirizi		16	13	77,250			Interrupted (2013)
8	Wambabya-Rwamarongo	Hoima	*S.neavei*	16	13	75,733			Interrupted (2013)
11	Maracha-Terego	Maracha-Terego*	*S. neavei/S. damnosum*	19	0	120,121			Interrupted (2012)
13	Obongi/Moyo	Moyo	*S. neavei/S. damnosum*	19	0	37,539			Interrupted (2014)
15	Nyamugasani	Kasese	*S.kilibanum*	19	0	11,368	10,237		Interrupted (2015)
9	Budongo	Buliisa	*S.neavei*	17	17	50,901		83,214	Interruption Suspected
		Hoima		17	17	77,782		128,724	Interruption Suspected
		Masindi		17	17	32,403		56,020	Interruption Suspected
10	Bwindi	Kabale	*S. neavei/S. damnosum*	15	13	31,372		49,996	Interruption Suspected
		Kanungu		15	13	60,483		97,942	Interruption Suspected
		Kisoro		15	13	38,669		62,372	Interruption Suspected
12	Nyagak Bondo	Arua*	*S.neavei*	20	7	175,600		298,448	Interruption Suspected
		Nebbi*		20	7	13,414		217,558	Interruption Suspected
		Zombo*		20	7	237,626		392,438	Interruption Suspected
17	West Nile	Arua*	*S. neavei/S. damnosum*	19	0	142,205	120874*		Interruption Suspected
		Koboko*		19	0	172,088	146275*		Interruption Suspected
		Yumbe*		19	0	295,213	250931*		Interruption Suspected

**Treatments in this area continue for LF*

Figure U6

Uganda: Financial Contributions in US Dollars (2001-2015)



The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.

Figure U7

2015 LF Treatments: Albendazole & Ivermectin for LF in Carter Center-Assisted Onchocerciasis Districts

District	Total Population	Ultimate Tx Goal (UTG)	Persons Treated	UTG % Coverage for Albendazole	Active Villages Cumulative	Active Villages UTG	Active Villages % for UTG
Adjumani	26,948	22,253	22,121	99%	43	43	100%
Moyo	85,520	74,657	70,559	95%	165	165	100%
Gulu	325,791	276,144	218,286	79%	231	231	100%
Pader	170,689	141,890	137,096	97%	612	612	100%
Kitgum	101,579	85,419	65,634	77%	234	234	100%
Lamwo	138,408	114,072	107,256	94%	327	327	100%
Oyam	22,473	19,252	17,945	93%	35	35	100%
Nwoya	139,066	114,509	104,077	91%	54	54	100%
Nebbi	133,414	108,779	102,076	94%	168	168	100%
Zombo	237,626	196,219	190,434	97%	625	625	100%
Arua	175,600	149,224	146,224	98%	325	325	100%
Total	**1,557,114**	**1,302,418**	**1,181,708**	**91%**	**2,819**	**2,819**	**100%**

SUDAN

Summary

Sudan has four known river blindness foci: Abu Hamad (River Nile state), Radom (South Darfur state), Galabat (Gedaref state), and Khor Yabus (Figure S1). In 2014 the Abu Hamad focus was in its third and final year of post treatment surveillance (PTS). In 2015 a major post treatment surveillance evaluation was successfully conducted in Abu Hamad communities. No disease recrudescence was observed and onchocerciasis transmission was declared eliminated in accordance with WHO guidelines. Mectizan® treatments continued in the other two transmission zones of the country (Radom and Galabat). However, no treatments have ever been launched in Khor Yabus due to civil strife and the need to reassess the area for evidence of active onchocerciasis transmission.

The Republic of Sudan was the first African country to declare a nationwide onchocerciasis elimination policy, in December 2006. The River Blindness Elimination Program has supported Sudan in this effort technically, although in recent years all programmatic support is provided by Sudan itself (an example for the rest of Africa to emulate).

In moving from a control to elimination strategy, Mectizan® treatments were increased in 2007 from annual to semiannual to accelerate elimination in the isolated desert focus of Abu Hamad in the River Nile state. Successful interruption of transmission was declared in Abu Hamad in 2012, and semi-annual treatment with Mectizan® ceased, and a three-year Post Treatment Surveillance (PTS) was successfully completed in 2015. In October 2015, a national program review was held with the support of The Carter Center to review, in particular, the entomological and serological data collected in the Abu Hamad transmission zone. At the conclusion of the meeting the State Minister of Health read a declaration that Abu Hamad had eliminated onchocerciasis (Figure ES15).

Semiannual treatment was launched in Galabat in the Gedaref State in 2011 (Figure S2). During 2015, Galabat focus continued treating semi-annually.

The strategy in the Radom focus of South Darfur remained a control strategy, as the area still experienced considerable insecurity that have affected access and program activities. The disease's geographical reach and the total affected population have never been determined since insecurity prevents mapping from being carried out safely. Similarly, the epidemiological status of the Khor Yabus focus is poorly understood. Galabat, Radom, and possibly Khor Yabus are on international borders and possibly represent areas where Special Intervention Zones (SIZs) need to be established with Ethiopia, South Sudan and the Central African Republic (Figure S1).

Treatments: A total of 141,860 treatments were delivered by the Sudan program in 2015 in Galabat (107,070) in two rounds and Radom (34,764) one round (Figure S3). Due to civil conflict, a proper census of the affected population in Radom has not been performed to date, so an ultimate treatment goal cannot be determined. Accordingly, an annual

treatment objective (ATO) based on the Mectizan® drug order request is used as the denominator.

Training and Health Education: During 2015, the program trained a total of 1,319 community-directed distributors (CDDs) of whom 38% were female. All trained CDDs were from Galabat focus (Figure S4).

Mectizan®: During 2015, 778,000 tablets were distributed in the Galabat and Radom foci with an average of 3.06 tablets per person. No severe adverse effects were reported. The program began in 2014 with a balance of 594,000 tablets.

Sustainability and Integration: Since 2007 the program has involved kinship/family groups in all foci in mobilization and health education, selection and training of CDDs, and distribution of Mectizan®. This policy has improved training figures and has reportedly also reduced demand for monetary incentives.

2016 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, SUDAN

Abu Hamad

- Publish the results of the post-treatment surveillance evaluations in Abu Hamad in 2016.

Galabat Focus in Gedaref State

- Await completion of entomological surveys in the cross border Special Intervention Zone (SIZ) with North Gondar before MDA in the Galabat focus is halted and the focus moved to the post treatment surveillance (PTS) phase.
- Encourage publication of experience of bi-national collaboration in assessment of cross-border focus.
- In collaboration with USF, conduct cytotaxonomy of the flies to identify the existing sub-species.

Khor Yabus and Radom

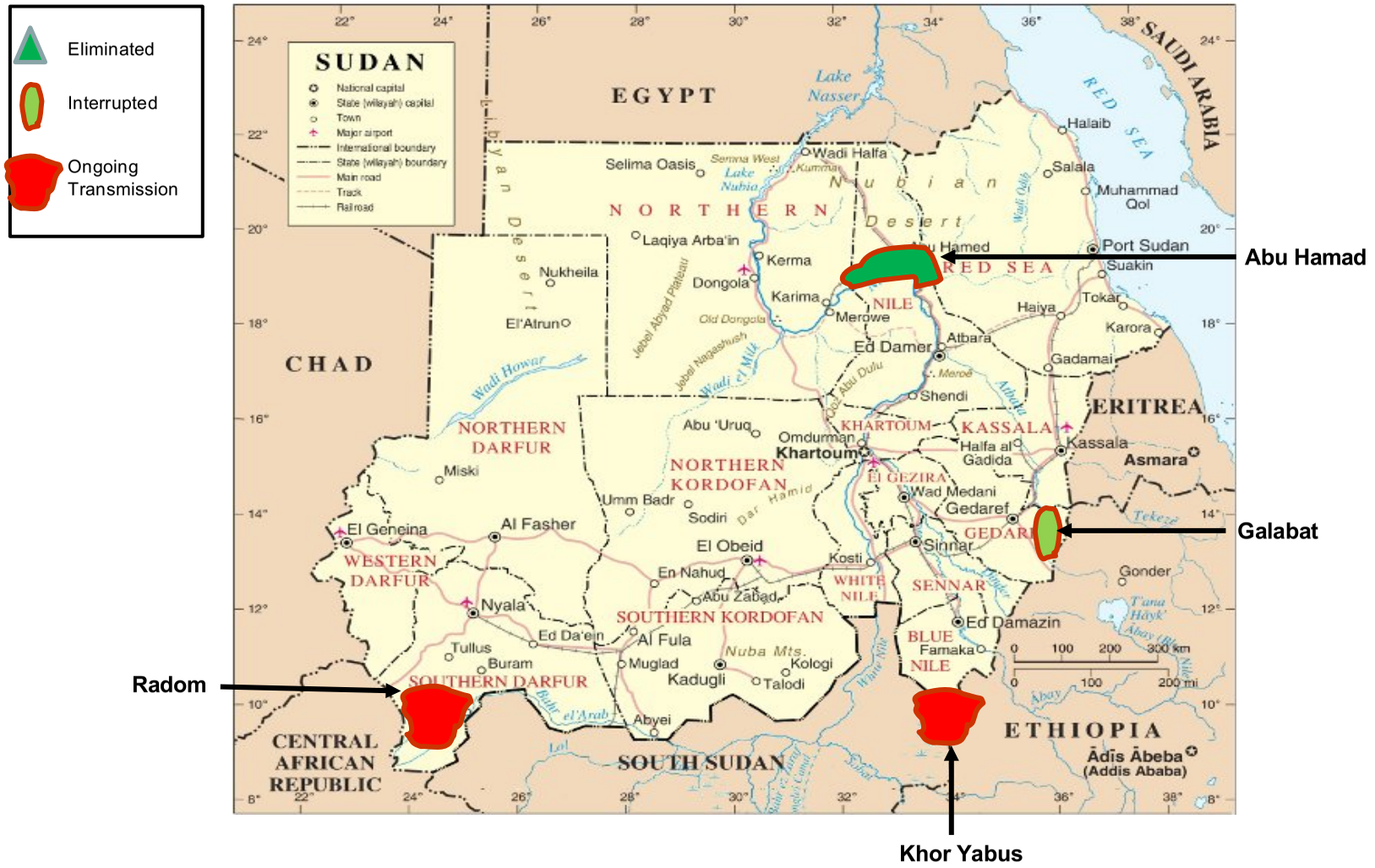
- Continue annual treatment in Radom as security allows.
- Baseline serological (OV 16) surveys in Khor Yabus should be conducted to establish if transmission is occurring there.
- If the area is shown endemic, then consideration should be given to whether a SIZ is needed between Sudan, Ethiopia and South Sudan around the Khor Yabus focus. As a first step, the SIZ should be delimited with similar OV16 surveys in South Sudan and Ethiopia.
- If an SIZ is needed, begin to discuss coordinated semi-annual treatment with ivermectin for the elimination of onchocerciasis across all international borders of the SIZ.

Treatment Objectives for onchocerciasis for 2016:

River Blindness	
Annual UTG	**23,427**
Semiannual UTG(2):	**246,180**

Figure S1

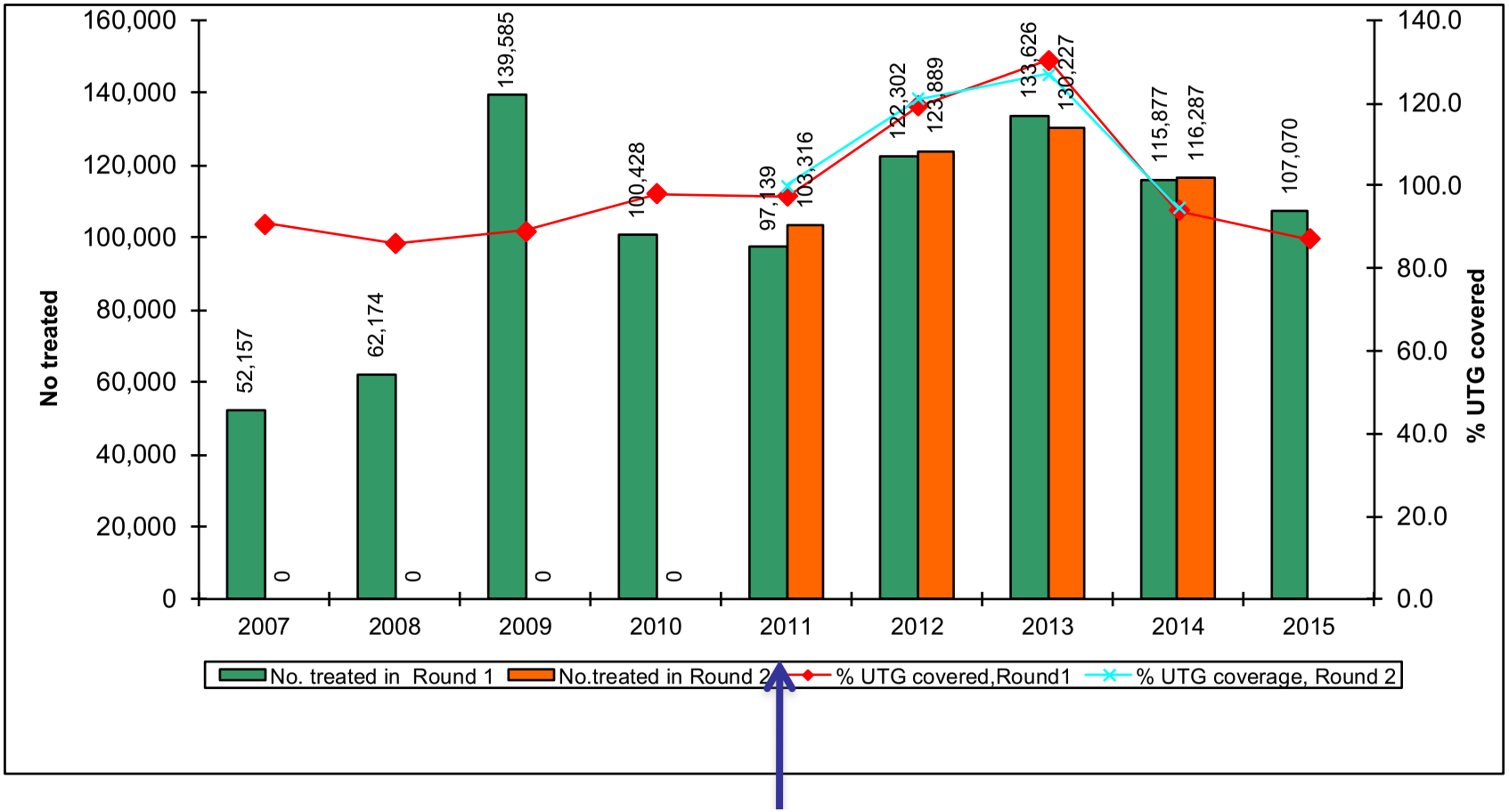
Map of Sudan Onchocerciasis Program Areas



Note that Radom, Khor Yabus and Galabat are likely cross border transmission zones

Figure S2

Mectizan Treatments and Treatment (UTG) Coverage in Galabat Focus, 2007-2015



Twice per Year Policy Implemented

Figure S3

Sudan: 2015 Treatment Coverage

Strategy	State	Focus	Total Population	UTG1	Treated in R 1	Treated in R 2	UTG Covered in R1	UTG Covered in R2	Total Treated	UTG 2	% UTG 2	Active Villages
Elimination	Galbat	Galbat	144,811	123,090	107,070	-	86.99	-	107,070	246,180	43.49	153.00
	Southern	Radom	25,947	22,055	34,764	-	157.62		34,764	22,055	157.62	19.00
Control	Passive		-	-	26				26	-	-	-

Figure S4

Number of CDDs Trained in Galabat Focus by Gender 2012 - 2015

Area	2012					2013					2014					2015				
	Total CDDs	Male CDDs	% Male	Female CDDs	% Female	Total CDDs	Male CDDs	% Male	Female CDDs	% Female	Total CDDs	Male CDDs	% Male	Female CDDs	% Female	Total CDDs	Male CDDs	% Male	Female CDDs	% Female
Galabat	527	292	55.41	262	49.72	824	510	61.89	314	38.11	859	528	61.47	331	38.53	876	539	61.53	337	38.47
Gorisha	238	137	57.56	101	42.44	319	170	53.29	149	46.71	335	176	52.54	159	47.46	343	180	52.48	163	47.52
Radom	93	93	100.00	0	0.00	100	100	0.00	0	0.00	100	0	0.00	0	0.00	100	0	0.00	0	0.00

NIGERIA

Summary

The River Blindness Elimination Program (RBEP) seeks to eliminate the transmission of onchocerciasis in the nine states it assists in Nigeria (Abia, Anambra, Delta, Ebonyi, Edo, Enugu, Imo, Nasarawa, and Plateau) (Figure N1) by 2020, in accord with the Federal Ministry of Health's Master Plan for NTDs. In 2015, 9,249,730 Mectizan® mass treatments (with health education) for onchocerciasis were distributed in Nigeria (Figures N2) with assistance from The Carter Center (TCC). This was approximately 20% of all RB treatments in Nigeria. In the special intervention zone on the Edo state border, twice-per-year Mectizan MDA for onchocerciasis was launched in 2015; to the best of our knowledge this was the first time twice-per-year MDA for RB has been used programmatically in Nigeria.

The Carter Center and its ministry of health partners successfully interrupted Lymphatic Filariasis (LF) transmission in Plateau and Nasarawa in 2012 with MDA/health education and long lasting insecticidal bed nets – LLIN). In 2013 the two states stopped nearly four million albendazole-Mectizan® treatments (Figure N4). The other seven states TCC assists in southeast Nigeria launched their own LF programs in 2014, and quickly scaled up to 10,042,479 treatments for the year (Figures N4 and N5). In the southeast, for the first time the Nigeria program successfully conducted twice-per-year MDA (using albendazole alone) for LF in Imo state; again, to our knowledge this was the first time twice-per-year MDA for LF has been used programmatically in Nigeria.

The Carter Center has been a leader in developing coordinated LF and malaria activities. In 2013 the Federal Ministry of Health adopted this as national policy and published the guidelines for coimplementation, with Carter-Center assistance. The Carter Center assisted the Nigerian National Malaria Program to distribute 2,065,753 long-lasting insecticidal nets (LLIN) in 2015.

In 2015 TCC assisted in providing 3,292,601 praziquantel treatments (with health education) for schistosomiasis in six states (Delta, Ebony, Edo, Enugu, Plateau and Nasarawa (Figures N6 and N7).

The Carter Center further expanded treatments for soil-transmitted helminths (STH) to 7,683,255, some of which occurred twice per year. This builds on major increases from the previous year, when the seven southeast states[1] began treatment for STH with mebendazole and albendazole (Figures N8 and N9).

The expanded activities in Nigeria are thanks in large part to TCC's partnership with USAID's ENVISION project, led by RTI International, along with other key partners, such as the Sir Emeka Offor Foundation, the Margaret A. Cargill Foundation, and the Izumi Foundation. Of course these programs would not be possible without donated

[1] Abia, Anambra, Delta, Ebonyi, Edo, Enugu, and Imo are collectively referred to in this document as 'southeast.'

products from many different partners (Merck, GSK, E-Merck, Johnson&Johnson, and Clark Mosquito Company).

River Blindness in Nigeria

***Background*:** Nigeria is home to about 40% of the global population at risk for onchocerciasis, making it the most endemic country in the world. The National Onchocerciasis Control Program (NOCP) is the largest Mectizan® distribution program globally, reporting between 20-35 million treatments per year (Figure N3). In 2013, the Federal Ministry of Health (FMOH) of Nigeria released a new master plan for neglected tropical diseases (NTDs) that articulated a new national policy of onchocerciasis elimination by 2020.

The RBEP in Nigeria is headquartered in Jos, Plateau state, with supporting sub-offices in Benin City, Enugu, Lagos, and Owerri. Active in nine states (Figure N1) since 1996, the TCC RBEP enjoyed LCIF support from 1999 to 2008, and core APOC support from 2000 to 2005. It currently receives funding from the Sir Emeka Offor Foundation, the Margaret A. Cargill Foundation, and USAID's ENVISION project, led by RTI International.

Treatments: In 2015, the TCC-assisted RBEP program in Nigeria provided health education and Mectizan® treatments to 9,249,730 persons (Figures N2 and N3), 92% of the UTG. No severe adverse events (SAEs) were reported following Mectizan® treatments in RBEP-assisted states in Nigeria in 2015. Particularly close monitoring for adverse reactions is carried out in the southeast because of the presence of *Loa loa* in that part of the country. *Loa loa* parasites release large numbers of microfilariae into the blood stream and death of these microfilariae after treatment with Mectizan® can, in rare cases, provoke severe adverse events (SAEs). Almost all Loa associated SAEs have occurred in Cameroon and DRC; few if any have ever been reported in Nigeria where Mectizan treatment has been ongoing in Loa endemic areas since 1993.

TCC-assisted treatments for LF, schistosomiasis, and STH are discussed in the Integrated Programs sections below.

Training and Health Education: In the nine states assisted by TCC there were 79,863 professional and lay health personnel involved in Mectizan® distribution in 2015: 69,086 CDDs and 10,777 community supervisors. One CDD served, on average, 480 persons. Just under half (45.6%) of CDDs were female. One community supervisor managed about six CDDs, on average, half as many as in 2014.

Financial Contributions: The Nigeria RBEP-assisted areas have had chronically insufficient government contributions at national, state, and local levels (Figure N10). For the past three years, major funding from USAID's ENVISION project, led by RTI International, has led to a marked increase in treatments, particularly for LF and STH. Financial contributions to the integrated programs are discussed in more detail in their sections below.

The Integrated Programs in Nigeria

Background: TCC-assisted programs in Nigeria pioneered the concept of using the RB mass treatment logistical system to 'piggy-back' launching of LF and SCH, sharing costs and infrastructure across several programs (Hopkins 2001). The integrated RB program began in 1999 with onchocerciasis and urinary schistosomiasis interventions, expanding to include LF MDA in 2000, trachoma in 2001, malaria in 2003, and STH in 2014. Background information on LF, SCH and STH is provided in Annexes 7 and 8. Integration results in broader services, lower costs, and higher efficiency among disease programs that use similar community-based strategies. The Carter Center pioneered 'triple drug administration' (TDA-simultaneous administration of ivermectin, albendazole, and praziquantel), demonstrating that TDA is safe, feasible, and gave enormous savings (40%) compared with giving two separate treatment rounds (ivermectin and albendazole separated from praziquantel) (Eigege et al. 2013, Evans et al. 2011).

Lymphatic Filariasis: The goal of the LF program is to interrupt LF transmission with MDA/health education, and distribution and use of LLIN. The TCC LF program in Plateau and Nasarawa was the first to be launched in Nigeria, in 2000. An in-depth history of the TCC effort in those states was published by Richards et al. (2011). When the program began, LF was widespread in Plateau and Nasarawa states, and mass treatment and health education was required in all cities and villages in the 30 LGAs of the two states. MDA started in 2000 and achieved scale in 2003 (Figure N4). In 2008, a survey for LF prevalence demonstrated that 10 of the 30 LGAs had achieved the elimination threshold (based on LF antigenemia prevalence) (King et al. 2012). Five of those LGAs were onchocerciasis-endemic, so Mectizan® treatment continued; in the other five LGAs MDA for LF was halted. The remaining 20 LGAs qualified to stop LF MDA through surveys conducted in 2012 using the newly released WHO Transmission Assessment Survey (TAS). Entomological assessments demonstrated that transmission was halted when LLIN were distributed (Eigege et al. 2013), and approximately 4 million treatments were halted at the end of 2012. At that time the 30 LGAs entered a period of post-treatment surveillance (PTS), beginning in 2013. In 2014, PTS TAS surveys confirmed that transmission remained interrupted in four LGAs that stopped LF MDA in 2010, while TAS surveys conducted in 2015 confirmed transmission interruption in the other 26 LGAs three years after halting MDA. Final "TAS-3" surveys, together with operational research investigating new diagnostic tools (Wb123) are planned in 2016 (4 LGAs) and 2017 (26 LGAs) to confirm elimination of LF across Plateau and Nasarawa. These studies are being conducted in collaboration with the NTD Support Center at the Task Force for Global Health.

In the seven TCC-assisted states in the southeast, LF MDA was launched in 2014 with support from USAID's ENVISION project, led by RTI International. Following the 'piggy-back' approach, the program began in LGAs with an existing river blindness program (Figure N4). It has grown rapidly to reach 18,458,493 treatments in 2015, expanding into LGAs without river blindness. This expansion has required establishing new MDA

infrastructure, including the purchase of motorcycles and vehicles, new training, etc. A particular challenge is the current WHO strategy for LF programs in Loa loa areas (which includes southeast) Nigeria which avoids the use of Mectizan® and the associated risk of SAEs. The WHO strategy calls for once, but preferably twice, per-year MDA with albendazole alone, together with LLIN. Twice-per-year treatments with albendazole were to have been launched in 2015, but did not take place due to non-arrival of the second round of drugs. The outlook for 2016 expansion of a target for twice-per-year treatment (29.1 million treatments), however, is good thanks to improved timeliness of drug shipments.

Fighting Malaria and Lymphatic Filariasis with LLINs: In Nigeria, LF is transmitted by the same mosquito that transmits malaria (*Anopheles gambiae* and *An funestus*). LLINs, one of the most important prevention tools for malaria, have been shown to also be useful as an adjunct to MDA in the LF elimination program. Between 2009 and 2013, all nine TCC-supported states received LLINs as part of the nationwide mass distribution of nets that aimed to provide two nets to every household. TCC has assisted with the distribution of 11.5 million LLINs in Nigeria since 2004; 2,065,753 of these were distributed by the TCC LF/MAL program in 2015.

In Plateau and Nasarawa, rates of LF-infected mosquitoes have been determined by dissection since the launching of the program (Richards et al., 2011). By the end of 2011, the year after mass LLIN distribution—the number of infected mosquitoes fell to 0% for the first time ever (Eigege et al., 2013). It is very likely that the effect of the LLINs was synergistic with MDA and helped to interrupt LF transmission completely. Additional results from a Bill and Melinda Gates Foundation funded TCC study in two states in the southeast (Imo and Ebonyi) showed that even in the absence of MDA, LLIN could interrupt LF transmission if used for sufficient time (Richards et al., 2013). GSK provided a three-year grant to TCC to evaluate if using CDDs could increase both LLIN ownership and use in order to reduce malaria transmission and prevent recrudescence of LF. Evaluation of this project, as well as Carter Center overall efforts to reduce malaria, were assessed through a large-scale malaria indicator survey (MIS) conducted in Plateau and Abia states in September—October, 2015. Final results from this survey will be presented at the 2016 program review.

Schistosomiasis/STH Control (see Annex 8 for background): The SCH program launched in Plateau and Nasarawa states in 1999 with a focus on *Schistosoma haematobium* infections (See Annex 8). The program remained limited for a number of factors, most importantly the lack of donated praziquantel (Richards at al. 2006, Gutman et al 2008, Gutman et al 2009), A major development was the 2008 donation of praziquantel through the World Health Organization (WHO) by Merck KGaA (E-Merck), Germany. This resulted in a major increase in treatment activities (Figure N7). TCC now assists schistosomiasis control in six states (Plateau, Nasarawa, Ebonyi, Edo, Enugu and Delta), providing 3,292,601 praziquantel treatments in 2015 (Figures N6 and N7). TCC receives support for schistosomiasis work from the Izumi Foundation and USAID. Double (Mectizan and praziquantel, mebendazole and praziquantel, or albendazole and praziquantel) or triple (ivermectin, albendazole and praziquantel) drug

administration is used wherever RB and LF MDA programs are also active, but only after one round of stand-alone treatment (i.e. drug administration staggered by at least 2 weeks) has occurred.

In accordance with WHO guidelines, adults and children were treated for schistosomiasis in LGAs that had average prevalence of greater than 50%, and school-aged children alone were treated where LGA prevalence exceeded 10%. In Plateau and Nasarawa states, where average LGA schistosomiasis prevalence did not exceed 50%, treatment was offered to all school-aged children.

Again, in accordance with WHO guidelines, school children are targeted for STH treatment in all nine TCC-assisted states. Treatments occur twice-per-year in the most highly endemic areas (Figures N8 and N9). In 2015, 7,683,255 million treatments were given. Only 139,211 were second-round treatments due to the fact that albendazole was delivered late to the program in 2015.

In Plateau and Nasarawa, where LF MDA has halted, the schistosomiasis/STH program is shifting from the old community-based LF-CDD model toward a new school-based - teacher model. The implications of the transition from the Ministry of Health toward the Ministry of Education are being studied.

2016 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, NIGERIA

Overarching for the three programs:

- Undertake rolling treatment coverage surveys, in close consultation with headquarters.
- Scale up capacity of Jos lab to serve as one of the national NTD support labs of Nigeria.
- Complete the "community census" to ensure that all existing communities are known in the Southeast states we support.
- Plan MDAs so that migrant populations will be in their village of registration when MDA is given.

Lymphatic Filariasis/Malaria:

- LF Malaria FMOH guidelines: Work to scale up and operationalize these guidelines in TCC assisted areas, especially with regard to LLIN use, care, and resupply.
- Publish results of CDD net monitoring from Kanke LGA.
- Expand behavior change communications (BCC) for bednets into additional LGAs in Southeast Nigeria.
- Complete analysis of the 2015 malaria indicator survey in Plateau.
- Publish results of post MDA LF TAS surveys in Plateau and Nasarawa.
- Complete field phase of the Task Force for Global Health funded research on post MDA surveillance in suspected LF transmission hotspots. **Include Seri sentinel village in cluster sampling in Kanke LGA (whenever possible, we should have purposeful sampling of LF or RB sentinel villages in any population-based survey activities).** Based on the epidemiological findings follow-up with entomological assessments as indicated.
- Help scale up LF MDA in SE Nigeria using guidelines appropriate for *Loa* areas, doing our best to solve albendazole supply issues that prevented us from using twice- per- year albendazole monotherapy in 2015. Work with University of Notre Dame on mathematical modeling Seri sentinel village.

Onchocerciasis:

- Work with the National Onchocerciasis Elimination Committee (NOEC) on which TCC is represented to define and implement national standards for halting MDA for RB and conducting Post-Treatment Surveillance (PTS), with due consideration of WHO guidelines.
- Provide financial and administrative support for the 2016 NOEC meeting.

- Work with NOEC to define and implement standards for stopping MDA in Plateau, and Nasarawa states. The NOEC should determine whether these surveys should include a Special Intervention Zone (SIZ) that includes non TCC assisted Border States such as Kaduna (supported by SightSavers). Conduct required surveys in 2016 such that MDA might be halted in 2017.
- Expand twice-per-year treatment on the Edo-Ondo SIZ, working in collaboration with MITOSATH.
- Encourage FMOH, WHO, and partner NGDOs to consider as SIZs other state cross- border foci, including those states surrounding Ebonyi state.
- Conduct research in likely onchocerciasis hypoendemic LGAs where *Loa loa* could be a major impediment to launching Mectizan MDA using new diagnostic techniques such as the OV16 RDT and the Loa CellScope.
- Work with University of Notre Dame on mathematical modeling of Bayan Dutse sentinel village.

Schistosomiasis (SCH) and soil transmitted helminthiasis (STH):

- In collaboration with the Federal Ministry of Health, produce the final report for the 2014 USAID ENVISION project-supported integrated mapping for schistosomiasis, STH, trachoma, and *Loa loa* in TCC-assisted states. Consider publication of the analysis of maximum values versus averages for STH and schistosomiasis.
- Develop a protocol to study cost and administrative advantages of treating annually in schools, at certain grade levels, rather than an entire school every other year or every three years, as recommended by WHO.
- Compare and publish the costs and effectiveness of three treatment approaches to reach school aged children: 1) teacher MDA, 2) CDD MDA and combination MDA (teacher and CDD).

Plateau/Nasarawa States 2016 Objectives:

Treatment Objectives:	
RB UTG	**2,043,789**
SCH UTG	**2,082,570**
STH UTG	**2,082,570**

Training Objectives:	
River Blindness	
CDDs	**5,890**
CSs	**731**

Schistosomiasis	
CDDs	**10,495**
CSs	**1,097**

Southeast States 2016 Objectives:

Treatments Objectives:	
RB UTG	**18,191,018**
LF UTG	**29,106,111**
STH UTG	**9,126,216**
SCH UTG	**2,839,621**

Training Objectives:	
River Blindness	
CDDs	**42,510**
CSs	**7,990**

Lymphatic Filariasis	
CDDs	**51,078**
CSs	**10,377**

Schistosomiasis	
CDDs	**7,235**
CSs	**6,180**

Figure N1

Nigeria: Carter Center-Assisted States

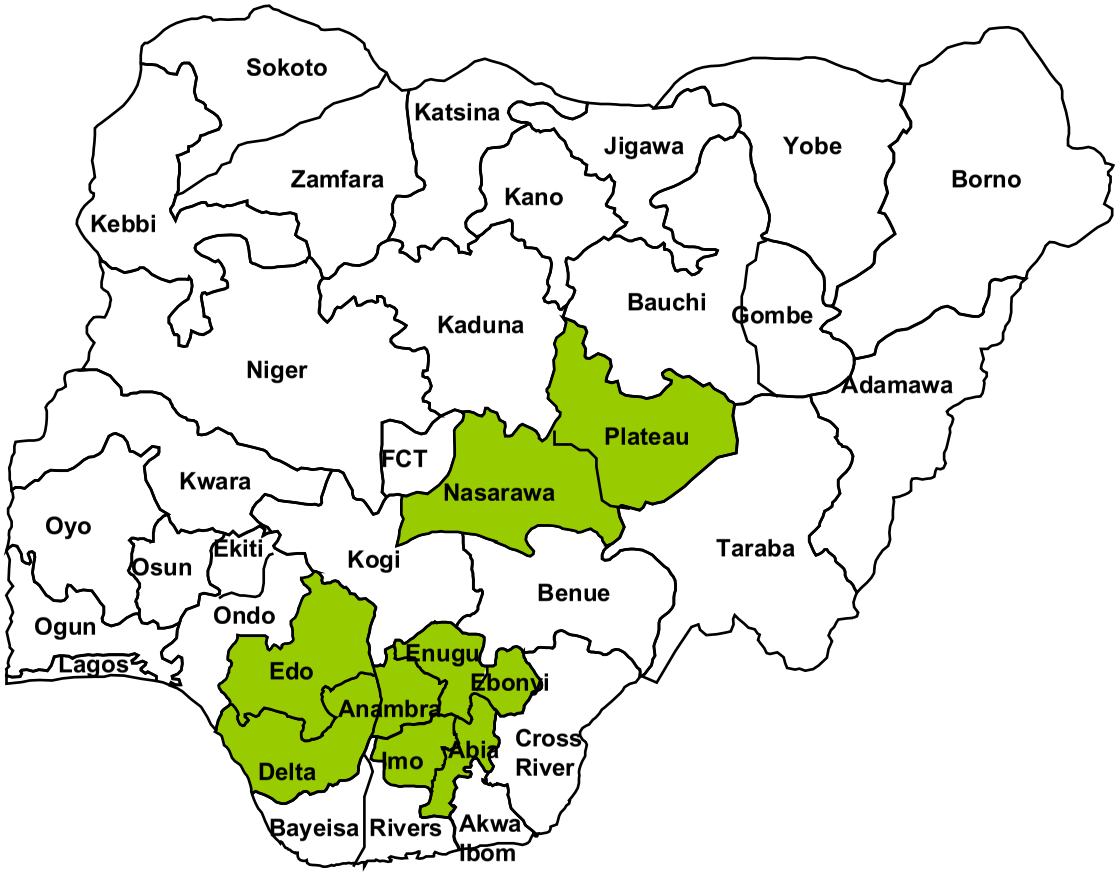


Figure N2

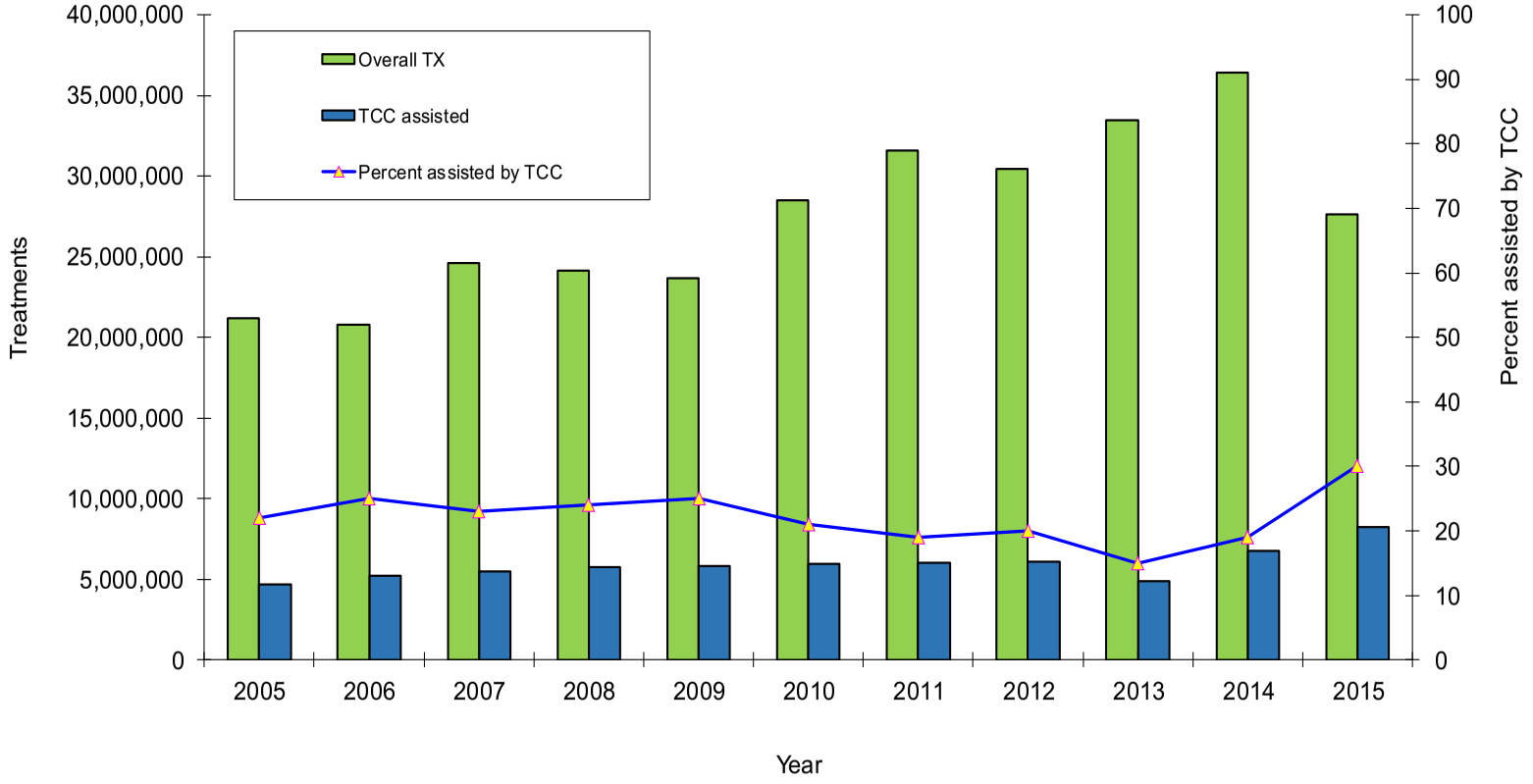
Nigeria: Carter Center-Assisted Areas
2015 River Blindness Treatments

State	Total Popn	Ultimate TX Goal (UTG)	PopnTreated	% of Total Popn Treated	% of UTG Treated	Active villages Treated	Active Villages UTG	% of Active Villages Covered
Enugu	1,150,890	920,712	835,838	73%	91%	4,229	4,229	100%
Anambra	825,200	660,160	557,558	68%	84%	1,669	1,669	100%
Ebonyi	693,728	554,982	539,461	78%	97%	2,369	2,369	100%
Edo	1,816,808	1,180,474	1,535,000	84%	130%	1,345	1,345	100%
Delta	698,575	558,860	565,797	81%	101%	725	725	100%
Imo	3,454,635	2,763,708	2,265,974	66%	82%	3,116	3,134	99%
Abia	1,501,193	1,200,954	1,113,392	74%	93%	1,621	2,193	74%
Plateau	978,015	782,412	730,264	75%	93%	290	296	98%
Nasarawa	1,408,693	1,126,954	1,106,446	79%	98%	589	589	100%
TOTAL	**12,527,736**	**9,749,216**	**9,249,730**	**74%**	**95%**	**15,953**	**16,549**	**96%**

Note: *The totals for Edo state include 354,615 treatments (130% of the goal) that were supposed to have been given as part of a twice-per-year treatment strategy. Only one treatment occurred in 2015, however.*

Figure N3

Nigeria: Carter Center-Assisted Treatments and Total Mectizan® Treatments Provided 1992-2015*



* Treatments in TCC areas from 1992-1995 were assisted by RBF. The 2015 national figure is provisional.

Figure N4

Nigeria: Carter Center-Assisted Lymphatic Filariasis Treatments (with Mectizan® and Albendazole) 2000-2015, and 2016 Target

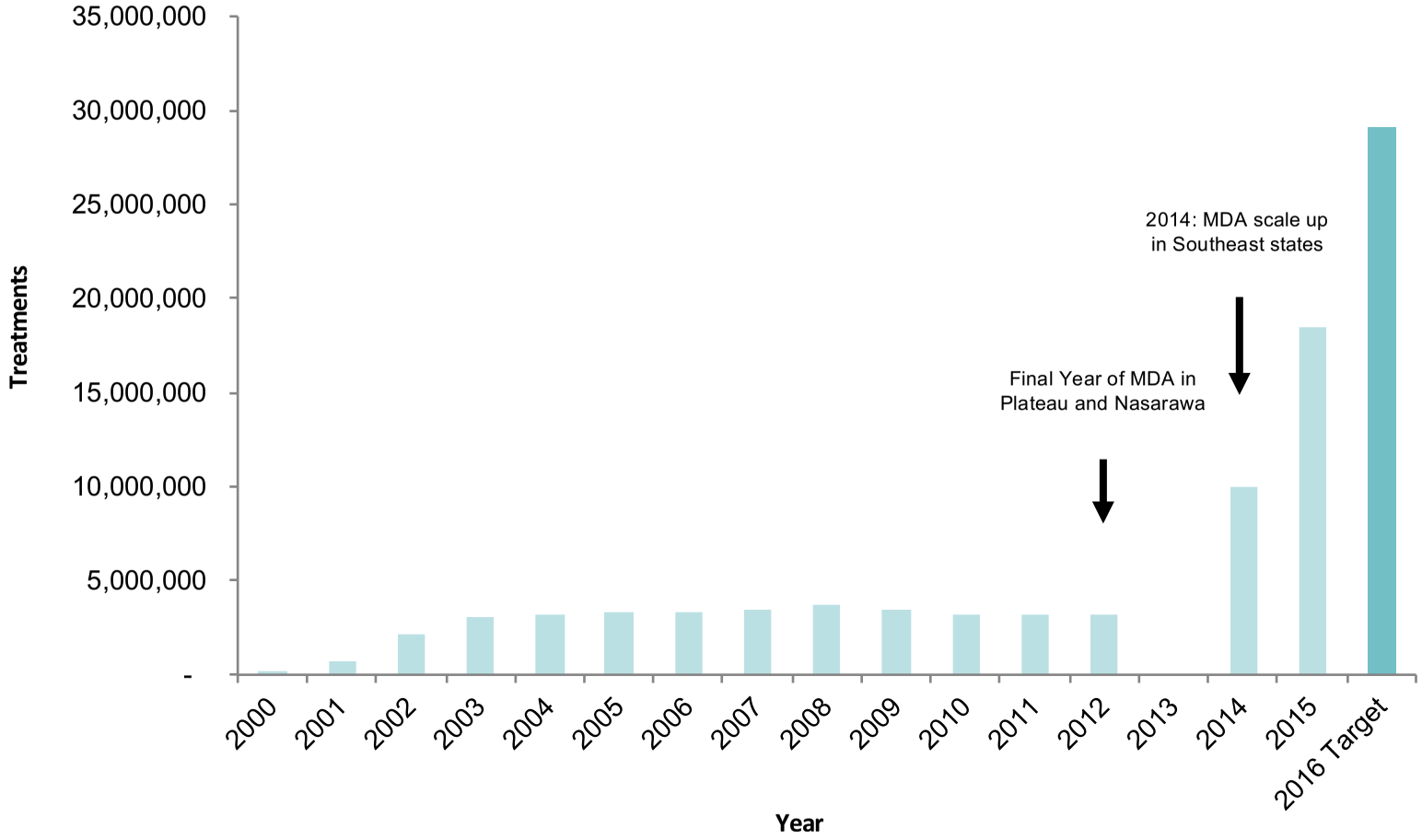


Figure N5

Nigeria: Carter Center-Assisted Areas
2015 Lymphatic Filariasis Treatments*

State	Number of LGAs	Population treated 2015	Ultimate treatment goal 2015	% UTG treated 2015	Total population 2015	% of total Popn treated 2015	Active villages treated 2015	Active villages UTG 2015	Active villages % UTG 2015
Enugu	14	2,528,526	2,583,740	98%	3,175,599	80%	3,960	5,449	73%
Anambra	21	4,112,847	4,178,228	98%	5,222,785	79%	4,349	4,349	100%
Ebonyi	9	1,522,191	1,524,089	100%	1,905,111	80%	2,293	3,161	73%
Edo	7	1,129,984	1,130,074	100%	1,412,592	80%	2,307	2,307	100%
Delta	16	2,308,048	2,356,067	98%	2,945,084	78%	2,345	2,345	100%
Imo	9	3,924,607	3,931,320	100%	4,914,150	80%	5,324	5,325	100%
Abia	9	2,837,890	2,862,196	99%	4,348,197	65%	3,831	3,838	100%
TOTAL	**85**	**18,364,093**	**18,565,714**	**99%**	**23,923,518**	**77%**	**24,409**	**26,774**	**91%**

** The program was also able to give a second round of treatment to 94,400 persons in one LGA in Edo State, for a total of **18,458,493** LF treatments in 2015*

Figure N6

Nigeria: 2015 Carter Center-Assisted Schistosomiasis Treatments

State	Annual Treatment Objective (ATO)	Popn Treated	% Of ATO Treated	Target Villages/Schools Treated	Target Villages/Schools	% of Target Villages/Schools Covered
Anambra	739,597	309,637	42%	1,535	1,582	97%
Delta	1,023,198	1,020,302	100%	1,184	1,184	100%
Ebonyi	341,308	309,254	91%	880	880	100%
Edo	729,312	729,312	100%	1,928	1,928	100%
Enugu	1,050,948	366,133	35%	2,064	3,096	67%
Nasarawa	147,664	145,611	99%	185	185	100%
Plateau	431,411	412,352	96%	562	597	94%
Total	**4,463,438**	**3,292,601**	**80%**	**8,338**	**9,452**	**94%**

Figure N7

Scale up of Carter Center-Assisted Schistosomiasis Treatments in Nigeria and 2016 Target

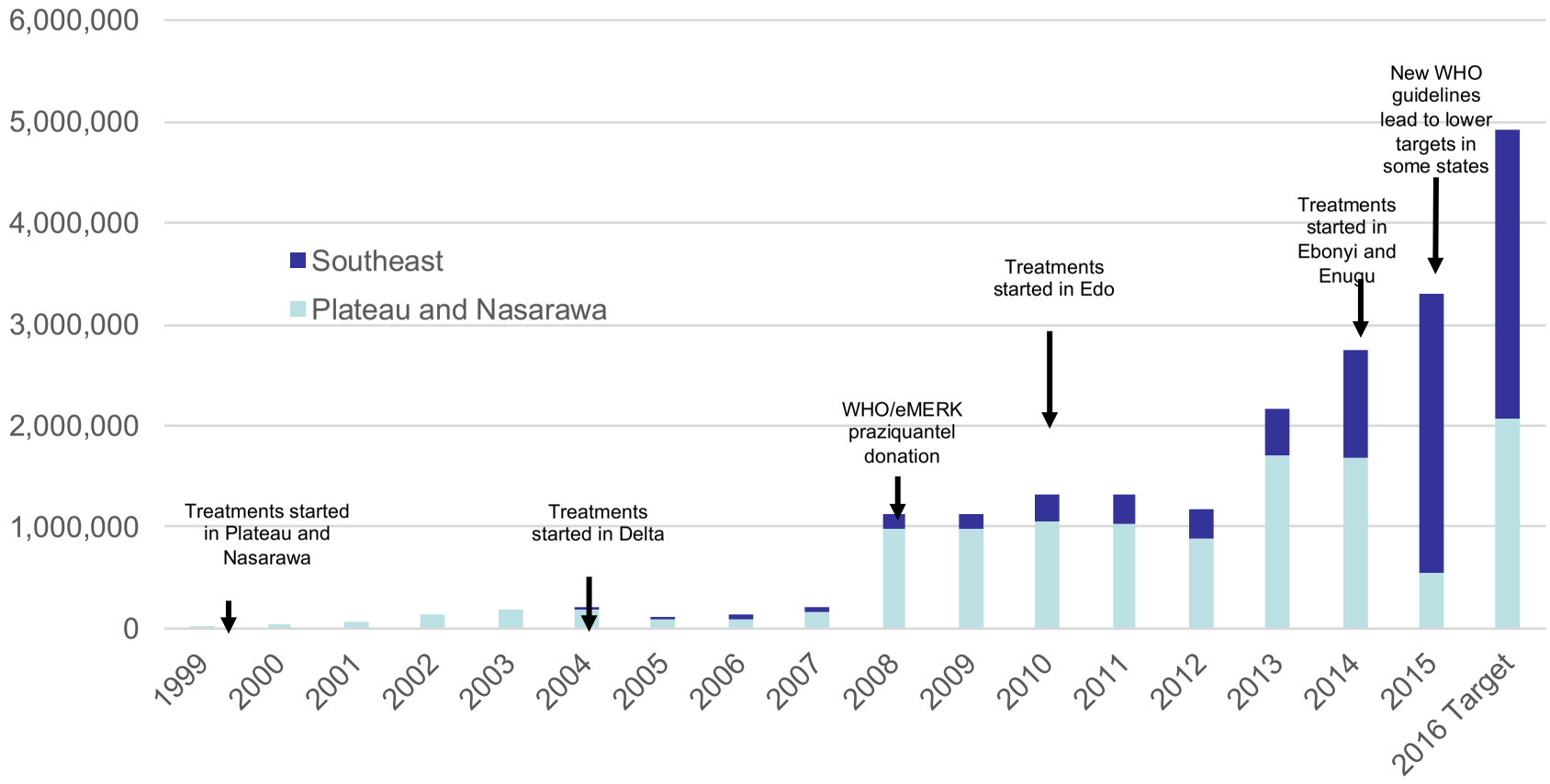


Figure N8

Nigeria: 2015 Carter Center-Assisted Soil Transmitted Helminthiasis Treatments

Round 1 and Annual Treatments

State	UTG	Popn Treated	% of UTG Treated	Target Villages Treated	Target Villages ATO	% of Target Villages Covered
Abia	979,496	820,125	84%	3,587	3,587	100%
Anambra	854,945	823,633	96%	1,055	1,055	100%
Delta	1,535,499	1,400,398	91%	848	848	100%
Ebonyi	633,800	631,952	100%	2,399	2,399	100%
Edo	1,205,777	1,234,139	102%	2,072	2,072	100%
Enugu	731,455	530,168	72%	2,796	2,935	95%
Imo	1,344,502	1,179,390	88%	4,999	4,999	100%
Nasarawa	558,071	562,506	101%	903	903	100%
Plateau	372,490	361,733	97%	1,080	1,139	95%
Total	**8,216,035**	**7,544,044**	**92%**	**19,739**	**19,937**	**99%**

Treatments in Round 2

State	UTG	Popn Treated	% of UTG Treated	Target Villages Treated	Target Villages ATO	% of Target Villages Covered
Ebonyi	184,708	108,956	59%	583	583	100%
Enugu	50,101	30,255	60%	133	133	100%
TOTAL	**1,238,651**	**858,152**	**69%**	**1,006**	**2,026**	**50%**

Figure N9

Soil Transmitted Helminthiasis Treatments, 2013 – 2015, and 2016 Target

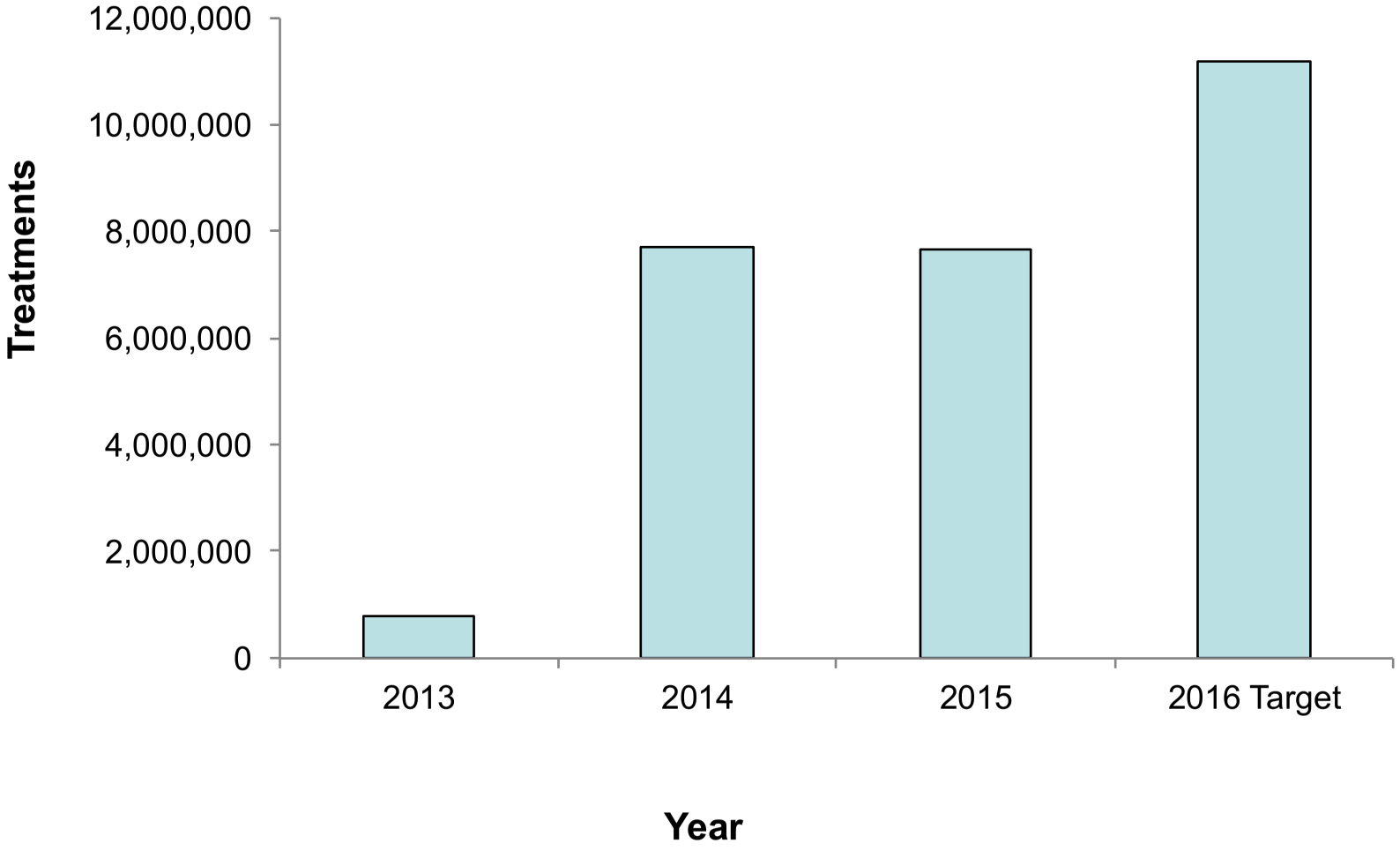
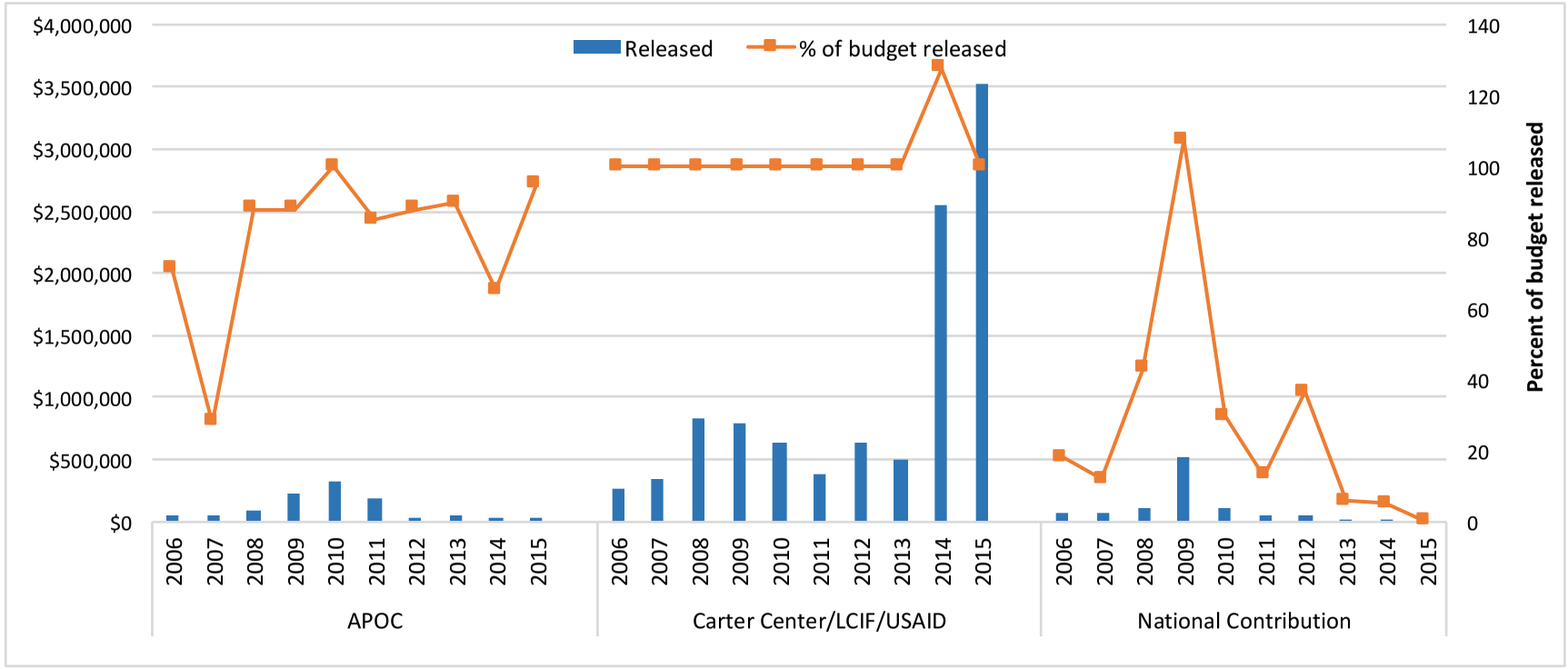


Figure N10

Nigeria: Financial Contribution* to RBEP by Individual Partners in US Dollars (2006 – 2015)



** The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.*

ETHIOPIA

Summary

Ethiopia continued its strong performance in its third year of conducting primarily twice-per-year treatments for river blindness, aggressively pursuing the national policy of onchocerciasis elimination by 2020. In 2015, Ethiopia delivered the most Mectizan® treatments of our assisted programs (Figure ES8); a total of 15,134,758 treatments were provided with 14.6 million of these in the twice-per-year strategy. Over 194,000 community drug distributors were trained, approximately 56,000 more than in 2014, and more than half were female (Figure ES10). The Lions-Carter Center SightFirst project in Ethiopia is based on a longstanding partnership with the Federal Ministry of Health, The Lions Clubs International Foundation SightFirst Program and the Lions Clubs of Ethiopia. Ethiopia also continued treatments for lymphatic filariasis, reaching 1.1 million treatments in a program supported by GSK.

During 2015, the second Ethiopia Onchocerciasis Elimination Expert Advisory Committee (EOEEAC) was held with the support of The Carter Center and its partners, and a new Carter Center–supported molecular laboratory in the Ethiopia Public Health Institute (EPHI) was formally opened by the State Minister of Health (Figure E1). The lab was renovated, equipped, and personnel trained; it is now fully operational and testing thousands of samples.

Ethiopia is the second most populous country in Africa with a population of about 94 million. Onchocerciasis was first reported in southwestern regions in 1939, while the northwestern part of the country was recognized to be endemic in the 1970s. A National Onchocerciasis Task Force (NOTF) was established in 2000, and the African Program for Onchocerciasis Control (APOC) began supporting Rapid Epidemiological Mapping of Onchocerciasis (REMO) in Ethiopia in 2001. This mapping identified and targeted 10 areas, primarily in the western part of the country, where the overall prevalence of onchocerciasis was estimated to be more than 40% (≥20% nodule rate) and thus eligible for APOC's community-directed treatment with ivermectin (CDTI) projects. The Carter Center, Lions Clubs International Foundation, and local Lions Clubs partnered with the FMOH and APOC in 8 of these 10 projects, beginning with Kaffa and Sheka zones in 2001. Since then, the River Blindness Elimination Program has expanded to include Bench-Maji, North Gondar, Illubabor, Jimma, Metekel and Gambella (Figure E2).

In 2012 the Federal Ministry of Health (FMOH) of Ethiopia released a new master plan for NTDs that included a change in policy from indefinite RB control to RB transmission elimination by 2020. As part of this policy change, and with support from the Lions Clubs International Foundation and other donors, The Carter Center assisted the MOH to provide almost 4.9 million treatments; a 50% expansion over treatments assisted in 2011. The increase was due to the launching of semi-annual treatments in new, previously unrecognized hyper, meso, and hypoendemic areas bordering old CDTI zones. The

pattern of increasing treatments has continued. About 8.5 million treatments were delivered in 2013, representing 3.6 million more treatments than were delivered in 2012 (a 75% increase). In 2014, with additional financial support from the Margaret A. Cargill Foundation and the Alwaleed bin Talal Foundation, the program expanded further both geographically and by adding semi-annual treatments with ivermectin. During 2015, the Carter Center assisted a total of 15,134,578 treatments representing a 37% increase from 2014 (Figure E3). The Ethiopia program surpassed Nigeria in 2015 to become the largest RB MDA program at The Carter Center.

Members of Lions Clubs District 411-A have always played a key role in both The River Blindness and Trachoma Control Programs in the Lions-Carter Center SightFirst project areas of Ethiopia. The Carter Center is grateful for the generous financial and programmatic support of the Lions Clubs, and especially the leadership of the Honorable World Laureate Dr. Tebebe Y. Berhan.

The Ethiopia Onchocerciasis Elimination Expert Advisory Committee (EOEEAC): The EOEEAC is tasked with providing the FMOH with a road map to nationwide interruption of onchocerciaisis transmission by 2020, with WHO verification as a goal shortly thereafter. The committee is composed of national and international experts, chaired by Dr. Mark Eberhard (former director of parasitic diseases at the CDC), who is supported by co-secretaries Mr. Biruck Kebede (FMOH NTD Coordinator) and Dr. Zerihun Tadesse (Ethiopia Country Representative of The Carter Center). The EOEEAC held its second meeting in Addis Ababa on October 6-8, 2015. The Director of National Disease Control, Dr. Amha Fantaye opened the meeting. Dr Pierre M'Pele-Kilebou (WHO Representative), the Honorable World Laureate Dr. Tebebe Y. Berhan (Lions Clubs International Foundation), and Dr. Frank Richards (Director RBEP, The Carter Center) gave opening remarks. EOEEAC launched national guidelines for elimination and recommended that the program broadly institute twice-per-year MDA in all newly discovered areas or where slow progress was being made toward the 2020 goal. The committee also recommended that national mapping be completed as rapidly as possible. Furthermore, it recommends that epidemiological and entomological data be collected before the 2016 EOEEAC meeting from Metema and West Armachio districts, where transmission appears to have been interrupted.

Treatments: The total number of treatments provided in 2015 was 15,134,578. Only 476,866 (3%) were annual treatments (Figure E4), while semi-annual treatments continued to expand (14,657,712 treatments were given semi-annually in 2015-Figure E5). Annual treatments were delivered in 1,184 communities and semi-annual treatments in 43,848, covering a total of 45,032 communities. Annual treatments covered reached 99% of UTG and semi-annual treatments reached 91% of the UTG(2), with geographic coverage at 100% of targeted villages (Figures E4 and E5). Carter Center-assisted treatments represented 87.2% of all treatments given in Ethiopia in 2015 (Figure E3), up from a low of 68% in 2011.

Training and Health Education: Training was provided to 194,135 community-directed distributors (CDDs) in 2015 (Figure E6); this was an increase of 56,398 trained CDDs (41%) over 2014. The percent of female CDDs showed an increase, from 50.5% in 2014 to 56% in 2015, continuing the trend begun in 2012 (Figure ES11). All zones except Gambella reached ratios of better than the target of 1 CDD per 100 population (average for Ethiopia 1:52).

A total of 39,809 community supervisors were trained in 2015, overseeing an average of 5 CDDs each, similar to the previous year. The proportion of community supervisors who are women increased slightly from 47% in 2014 to 48%.

Financial Contribution: Carter Center 2015 contributions (that include key funding from the Lions Clubs International Foundation, the Margaret A. Cargill Foundation, the Alwaleed Bin Talal Foundation, and individual donors to The Carter Center) continued to increase in support of an expanding Ethiopian RB elimination effort. The figure shown for the government investment in the program dramatically decreased because dedicated RB funding could not be determined; only salary figures for dedicated personnel were reported (Figure E7).

Lymphatic Filariasis (LF): The LF program in Ethiopia began in 2008 with GSK support for surveys in zones in western Ethiopia (Shiferaw et al. 2011). Co-endemicity of LF in Carter Center-assisted onchocerciasis areas was found in several woredas and, in 2009, GSK supported a pilot project to build LF treatments into the existing RB program in Gambella region, providing roughly 75,000 treatments. In 2012, with further support from GSK, treatments expanded to LF RB co-endemic woredas in Bench Maji, Metekel, and North Gondar zones, increasing the UTG nearly 10 fold. In 2015, expansion has continued, with a total of 1,114,753 LF treatments (Figures E8 and E9). As the RB program expands into new areas, co-endemicity with LF needs to be determined to adjust treatment regimens to include albendazole.

Other Integration: In the North Gondar zone (Amhara region) the RB LF integrated program works with Carter Center-assisted trachoma control activities.

2016 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, ETHIOPIA

Onchocerciasis

- Seek a binational decision with Sudan in 2016 for halting MDA in the cross border Special Intervention Zone (SIZ) between Galabat and North Gondar by:
    - Complete entomological surveys on the border of Ethiopia in Metema and West Armachiho.
    - Conduct RB blood spot mapping surveys (per mapping protocol) in the neighboring districts of Quarra, Tach Armachiho, Chilga, Takusa and Alefa.
    - Prioritize lab work so that the most urgent data (especially entomology and serology results for North Gondar) are available in time for the 2016 EOEEAC meeting.
    - Completing an LF TAS in Metema and Quarra (see LF section below).
- Conduct extensive training and capacity building in all zonal coordination offices to acquaint teams with the various protocols that have been established (assessment, mapping, entomology, and sentinel village RB).
- In consultation with HQ, complete impact assessments (using the assessment protocol) in Metekel and any other annual treatment TCC assisted areas to determine if annual strategies should shift to twice-per-year treatments.
- In consultation with HQ, obtain data (using the mapping protocol) to determine if treatments are needed in all districts of the TCC expansion zones. Priority should be given to determine treatment needs in Awi, West and East Gojjam in Amhara. If needed treatments in any new area should be twice per year.
- In consultation with HQ, determine impact of treatment in several villages where the assessments two or more years ago showed continued high mf skin prevalence. Use the onchocerciasis sentinel village protocol for these assessments. Continue to monitor these villages as sentinels every two to three years.
- In consultation with HQ, continue river prospection in all assisted zones in order to identify river systems responsible for black fly breeding and onchocerciasis transmission, guided by the entomology protocol.
- Expand the use of black fly traps in selected fly collection sites. In consultation with HQ, calibrate black fly collection on traps with nearby collections on human attractants.
- As resources allow and with close consultation with FMOH/EPHI, continue mapping of the eastern extent of river blindness in Ethiopia, using the mapping protocol.
- Provide financial and administrative support for the 2016 EOEEAC meeting.

Lymphatic Filariasis

- In consultation with HQ, conduct Transmission Assessment Survey in Metema and Quarra.
- In consultation with HQ, select LF sentinel village and establish monitoring in these using the LF sentinel village protocol.

Treatment Objectives for 2016:

River Blindness	
Semiannual UTG(2):	**18,504,287**

Lymphatic Filariasis	
Annual UTG(1):	**1,746,116**

Training Objectives	
CDDs:	**214,775**
CSs:	**42,974**

Figure E1

Inauguration of the Molecular Laboratory that Supports the National Onchocerciasis Elimination Effort in Ethiopia (October 7, 2015)

From L-R: Dr. Adrian Hopkins (Task Force for Global Health), Dr. Frank Richards (Carter Center), Dr. Tom Unnasch (University of South Florida), Hon. Kebede Worku, State Minister of Health (FMOH), Dr. Amha Kabede, Director (EPHI), Mr. Aderajaw Mohamed (Carter Center Ethiopia), Mr. Biruck Kebede (FMOH)

Figure E2

Ethiopia: Carter Center-Assisted CDTI Projects in 2015

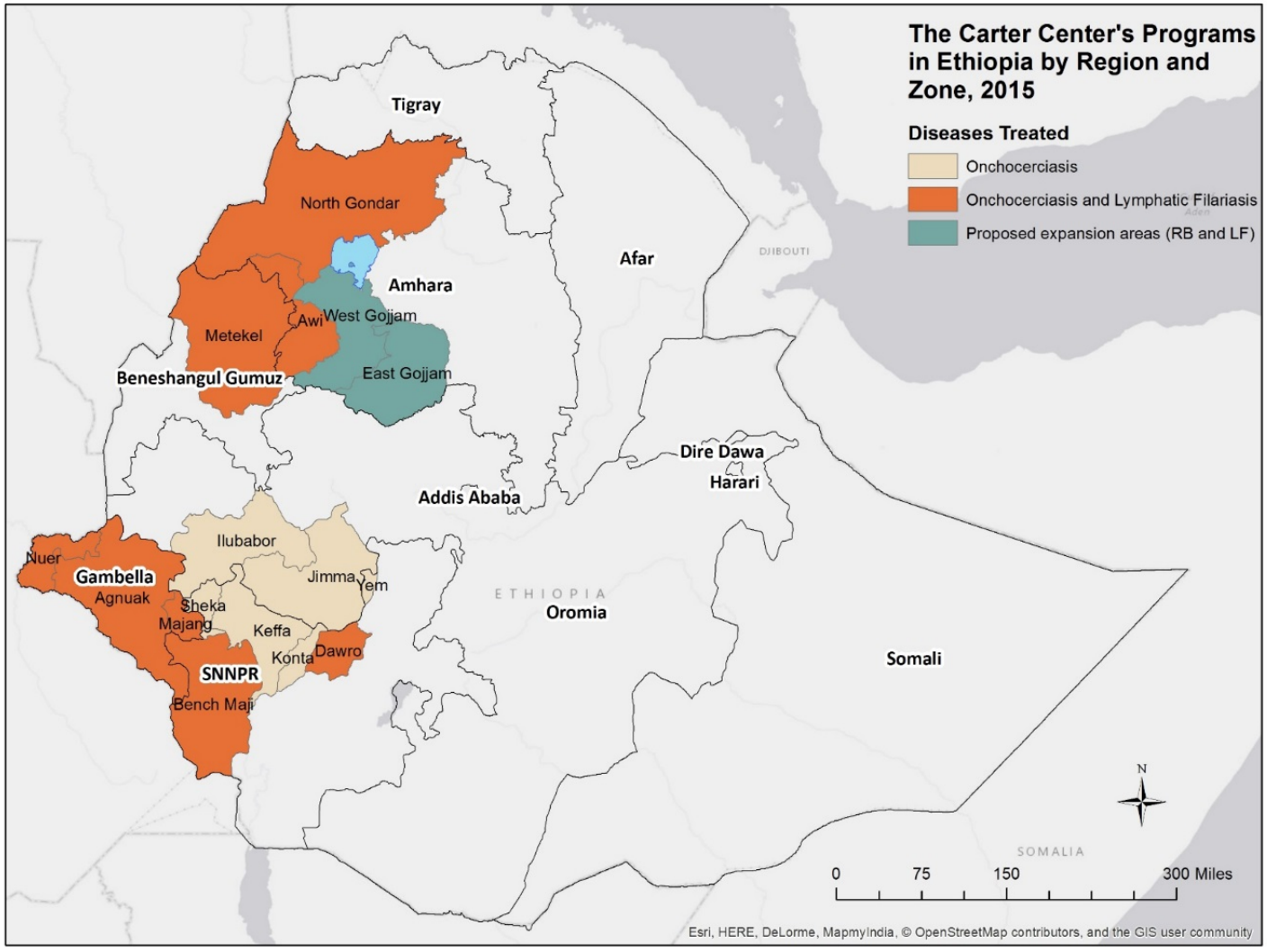


Figure E3

Ethiopia: Carter Center-Assisted Mectizan® Treatments as Proportion of Total Treatments Provided, 2001-2015

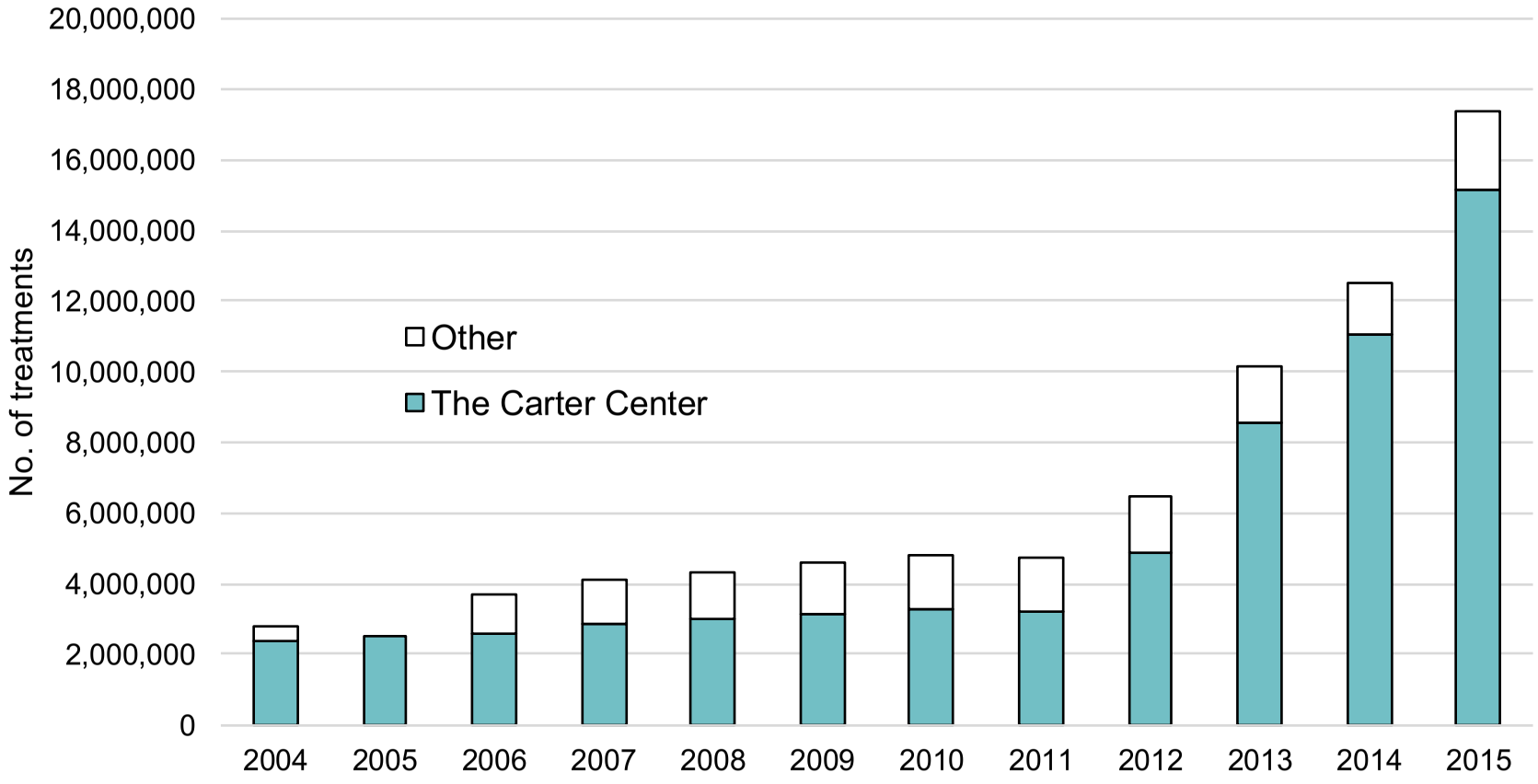


Figure E4

Ethiopia: 2015 Carter Center-Assisted <u>Annual</u> River Blindness Treatments

Region	Zone	No. of Districts	No. of Communities	Total Population	Eligible Pop/UTG	No. treated	Percent treated (UTG)	No. of Communities Treated	Percent of Communities Treated
Amhara	North Gondar	5	788	380,678	319,770	316,380	99%	788	100%
Beneshangul Gumuz	Metekel	4	396	190,397	159,933	160,486	100%	396	100%
	Total	**9**	**1,184**	**571,075**	**479,703**	**476,866**	**99%**	**1,184**	**100%**

Figure E5

Ethiopia: 2015 Carter Center-Assisted Semi-Annual River Blindness Treatments

Region	Zone	No. of Districts	Total Pop.	UTG 1	No. treated R1	Percent (%) UTG 1	UTG 2	No. treated R2	No. treated UTG 1 & 2	Percent (%) UTG 2	No. of Com's	Percent (%) of Com's Treated
SNNPR	Kaffa	11	1,126,145	945,962	941,053	99	1,891,924	954,755	1,895,808	100	4,493	100
	Sheka	5	215,625	181,125	181,509	100	362,250	187,550	369,059	102	1,310	97
	Bench Maji	10	822,550	690,942	685,231	99	1,381,884	687,184	1,372,415	99	3,331	100
	Dawuro	6	523,360	439,622	149,011	34	879,245	273,341	422,352	48	2,097	100
	Konta	1	113,623	95,443	91,990	96	190,887	-	91,990	48	500	100
	Yem	1	85,011	71,409	-	-	142,818	66,405	66,405	46	519	100
Amhara	North Gondar	3	558,115	468,817	270,972	58	937,633	255,678	526,650	56	2,004	100
	Awi	9	1,007,606	846,389	457,702	54	1,692,778	816,906	1,274,608	75	5,485	100
Oromia	Illubabor	24	1,601,123	1,344,943	1,336,290	99	2,689,887	1,363,558	2,699,848	100	8,169	100
	Jimma	18	3,153,257	2,648,736	2,618,727	99	5,297,472	2,690,849	5,309,576	100	14,905	100
Beneshanghul Gumuz	Metekel	3	194,088	163,034	164,553	101	326,068	165,291	329,844	101	505	100
Gambella	Gambella	7	193,669	162,682	151,681	93	325,364	147,476	299,157	92	530	100
Total	**12**	**98**	**9,594,172**	**8,059,104**	**7,048,719**	**87**	**16,118,209**	**7,608,993**	**14,657,712**	**91**	**43,848**	**100**

Figure E6

Ethiopia: Community Directed Distributors (CDDs) and Community Supervisors (CSs) Trained (2005 - 2015) in Carter Center-Assisted Areas

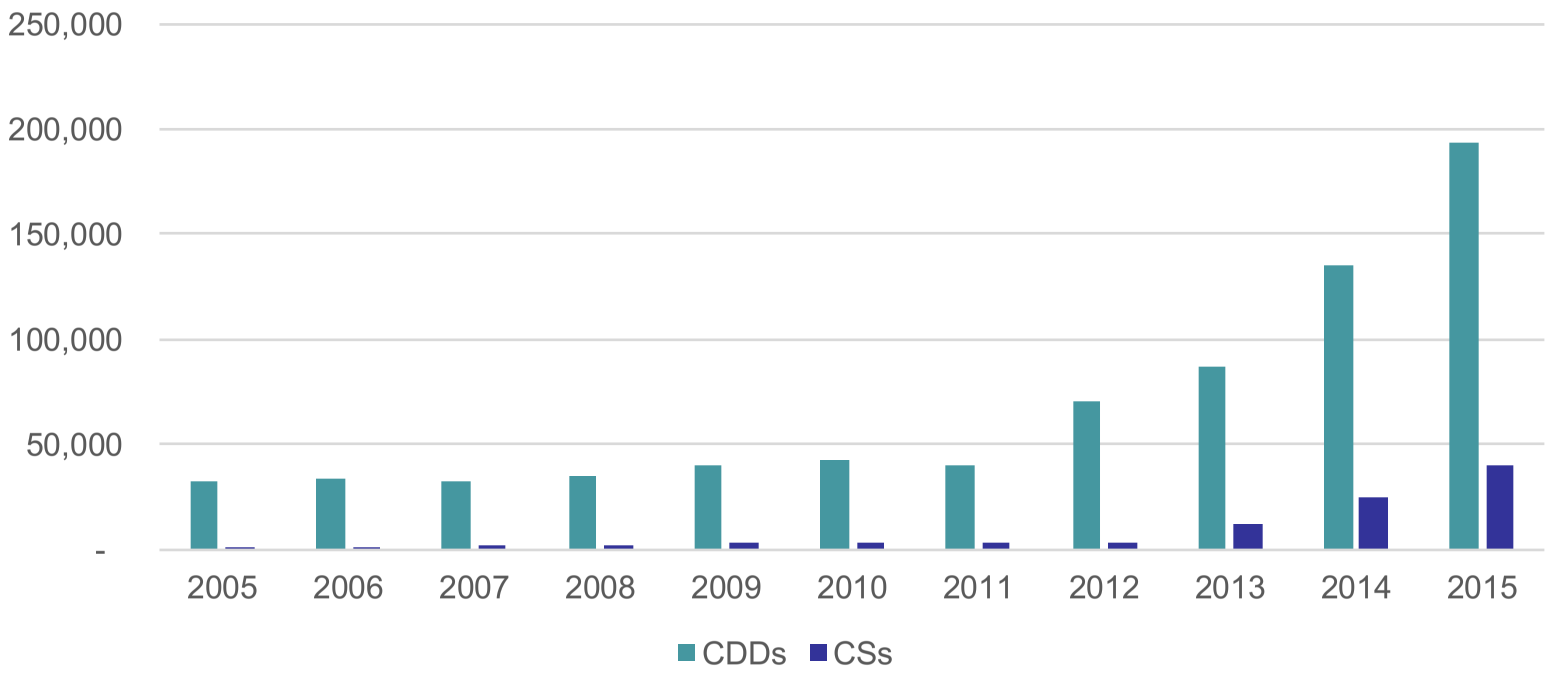
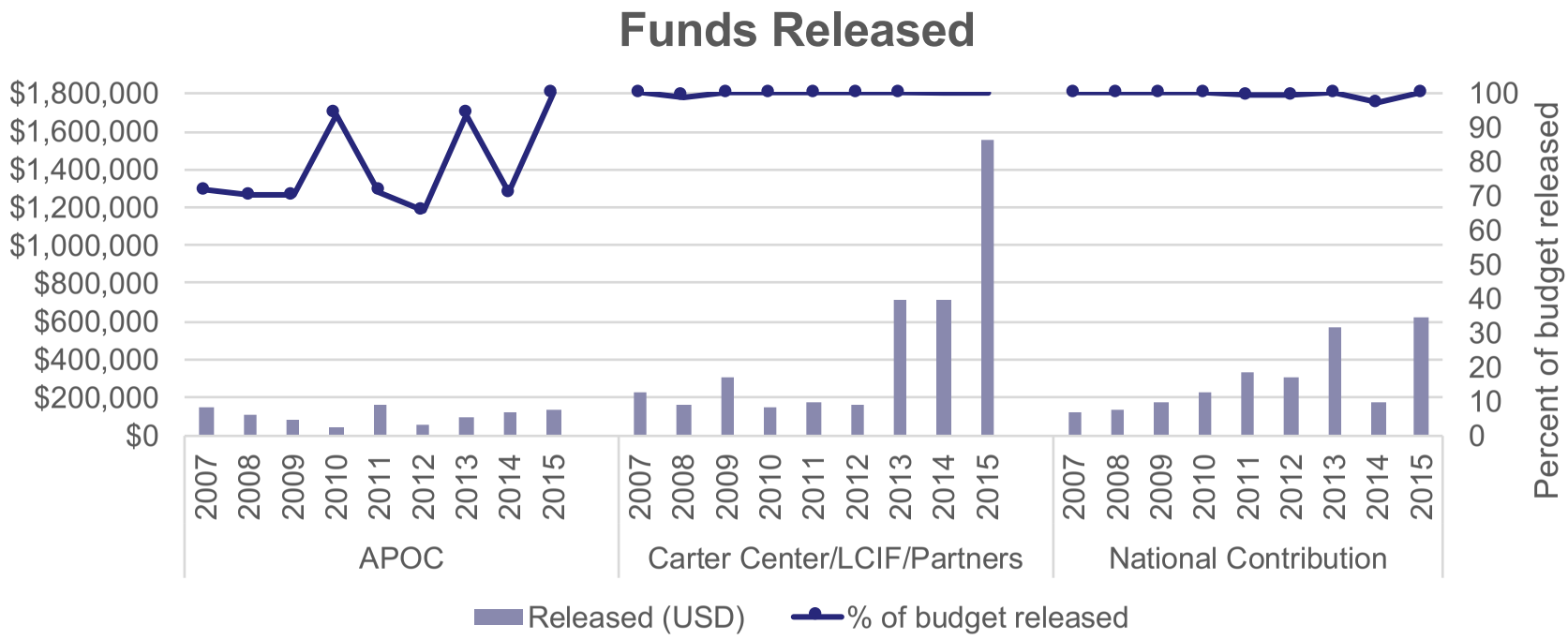


Figure E7

Ethiopia: Financial Contribution by Different Partners (US$) 2004 - 2015



1. The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.

2. Actual Cash contribution by Government to program implementation is not available. The graphic above only shows Staff salaries.

Figure E8

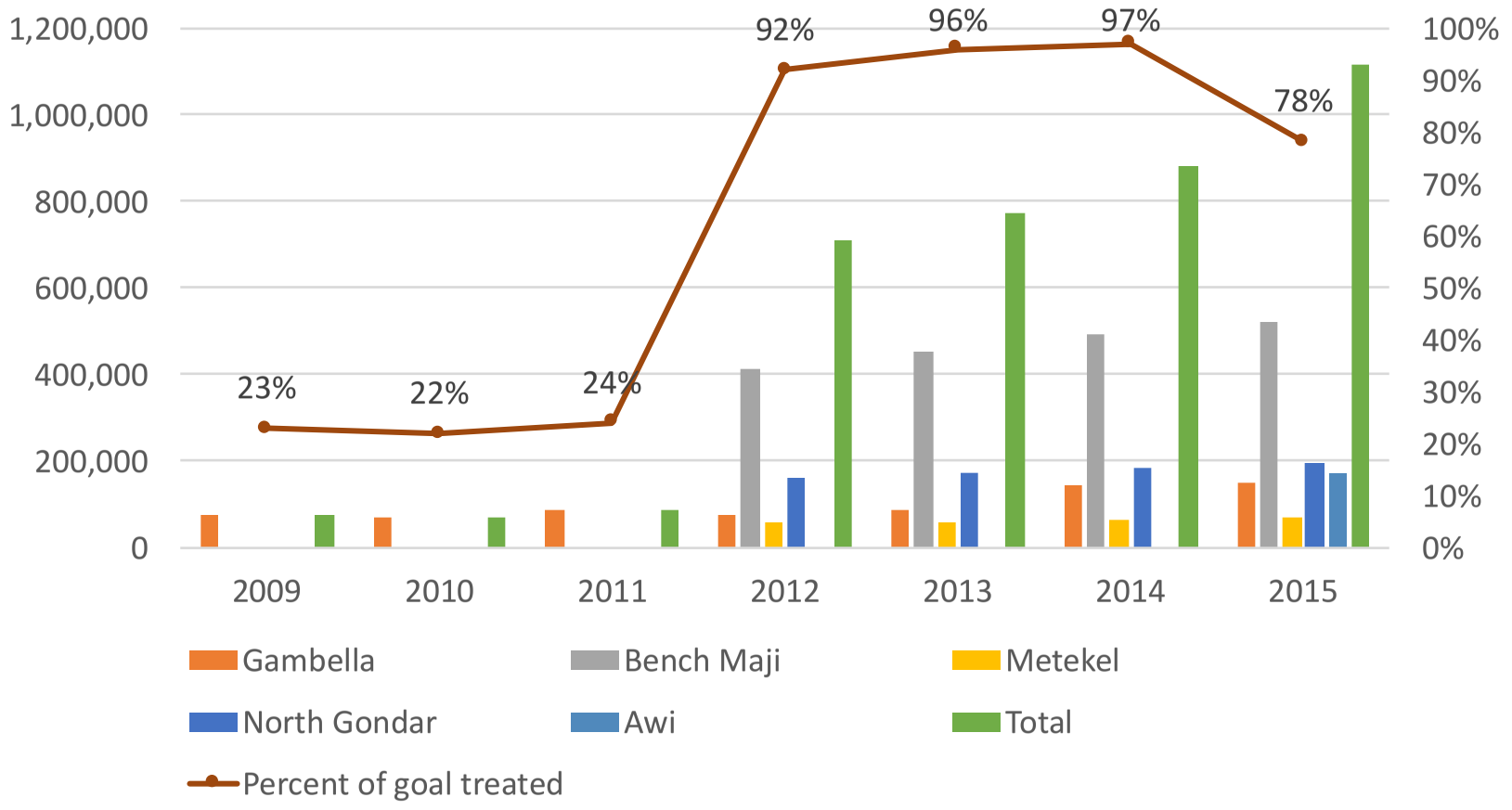
Ethiopia: Carter Center-Assisted Lymphatic Filariasis Treatments in 2015

Region	Zone	No. of Districts	No. of Communities	Total Population	Eligible Population	No. Treated	% Treated (UTG)	No. of Com's Treated	% of Com's Treated
Gambella	Agnwa & Mezheng	7	530	193,669	162,682	148,405	91	530	100
SNNPR	Bench Maji	8	2,750	630,666	529,759	524,464	99	2,750	100
Benshangul G.	Metekel	2	212	82624	69,404	70,333	101	212	100
	North Gondar	3	417	236,786	198,900	197,345	99	417	100
Amhara	Awi	5	2,667	551,233	463,036	174,206	38	652	24
Total		**25**	**6,576**	**1,694,978**	**1,423,782**	**1,114,753**	**78**	**4,561**	**69**

Note: *In Awi zone, the coverage was low because MDA only began in late 2015, and only 24% of communities could be reached.*

Figure E9

Carter Center-assisted Lymphatic Filariasis Treatments in Ethiopia by Region and Year 2009 to 2015



ANNEX 1: BACKGROUND

Human onchocerciasis, an infection caused by the parasitic worm *Onchocerca volvulus,* causes chronic skin disease and severe itching, as well as eye lesions that can progress to visual loss or complete blindness. The worms live in fibrous 'nodules' that often can be felt just under the skin. Onchocerciasis is transmitted by small black flies that breed in rapidly flowing rivers and streams, thus leading to the common name for the disease, "river blindness." The WHO estimates that approximately 37.2 million people are infected and 770,000 are blinded or severely visually impaired in 36 endemic countries. Approximately 123 million people live in endemic areas worldwide and are therefore at risk of infection; more than 99% of those at risk reside in Africa. Periodic mass treatment with the oral tablet Mectizan® (ivermectin, donated by Merck) prevents eye and skin disease caused by *O. volvulus* and may also be used to reduce or even interrupt transmission of the disease depending on the duration and frequency of treatment, the efficiency of the vector, and the geographic extent of the distribution programs.

The Carter Center River Blindness Elimination Program is dedicated to safe and sustainable mass distribution of Mectizan® with health education to eliminate onchocerciasis. The distinction between control and elimination is important. In the control approach, Mectizan® is distributed only in areas where the morbidity from the infection is greatest (meso- and hyperendemic areas) in a manner in which MDA will likely need to continue indefinitely because onchocerciasis transmission persists and people continue to get new infections ('open system'); sustainability of control programs is vital. In the elimination approach, Mectizan® treatment is used more intensively to 'close the system' so that transmission can eventually be broken. At a point when the residual parasites in the human population are unable to recover, the MDA can be stopped because there is no animal or environmental reservoir of infection. Before 2013, the elimination of onchocerciasis was the program goal in the Americas, Uganda and Sudan. By 2013, national onchocerciasis transmission elimination had become the stated goal of all the governments where RBEP assists. At that time RBEP set a new goal to stop transmission in all its assisted areas. Of note, we also advocate for our programs to cooperate and integrate when possible with the national LF programs of these countries, which also use (in Africa) MDA with Mectizan.

A major focus of TCC in order to achieve impact on RB is reaching the best possible treatment coverage, monitored through routine monthly reports by assisted programs and periodic coverage surveys and on achieving impact on RB itself. Annex 3 is a discussion of this reporting process and treatment indices used by the program and in this report. Important coverage terms include the **Ultimate Treatment Goal** (**UTG**), which is the number of treatment-eligible people living in a program area (persons >5 years of age); the **UTG(2) and UTG(4)**, used by elimination programs in areas where semiannual or quarterly treatments are required to break transmission; the **Annual Treatment Objective** (**ATO**), which is an interim target population in programs that are not operating at full scale due to initial operational limitations or financial resource constraints; and **full coverage**, which is defined as >90% achievement of the UTG,

UTG(2), or UTG(4) (85% for OEPA). **Passive treatments** are Mectizan® treatments for onchocerciasis provided through health care units located in hypoendemic communities (where estimated onchocerciasis nodule prevalence is under 20%) in the control program strategy. In elimination programs, hypoendemic villages receive mass treatment (not passive). As TCC-assisted programs are transitioning to the elimination mode, most passive treatments have been phased out of RBEP strategy.

Mectizan® tablets are distributed in Africa at the community level by grassroots community volunteers known as Community Directed Distributors (CDDs) through a process known as Community Directed Treatment with Ivermectin (CDTI); CDTI was perfected by the Tropical Disease Research (TDR) program of WHO and was broadly introduced into African Programme for Onchocerciasis Control (APOC) supported project areas throughout Africa in the late 1990's. In some areas, TCC's RBEP focuses on "kinship-enhanced CDTI," an approach that seeks to train more CDDs than is done in classic CDTI, and which TCC developed and pioneered in Uganda. In kinship-enhanced CDTI, CDDs serve within their own kinships or neighborhoods within every community where decisions and activities about treatments are handled. This strategy seeks to increase the active participation of members of affected communities by: 1) training as many inhabitants of endemic villages as possible to serve as distributors; 2) encouraging the involvement of women; 3) reducing the demand for financial or other "incentives"; and 4) allowing community members to choose their own health workers and the time and location of treatments. Monitoring indices of the kinship approach include 1) community selection of CDDs in every kinship/neighborhood zone in the community; 2) sustained treatment coverage of at least 90% of treatment-eligible persons; 3) increasing involvement of women as CDDs; and 4) the presence of at least two community selected supervisors in every community. The ratio of CDD per population most of our programs pursue is at least 1 CDD per 100 persons to be treated in all communities. The Ethiopia government policy uses members of its Health Development Army to support a ratio of 1 CDD per 30 persons.

The CDDs and community supervisors are often also highly engaged in other community- based health interventions, such as water provision and sanitation, malaria control, immunization, and integrated NTD control efforts.

ANNEX 2: A Timeline of the River Blindness Campaign at the Carter Center

- **1996:** The Carter Center assumed activities of the River Blindness Foundation and began assisting RB programs in the Americas, Nigeria, Cameroon, Sudan and Uganda. Ethiopia started in 2001.
- **1998:** Richards, with other TCC authors (Miri and Sauerbrey) writes about opportunities for RB elimination in a special edition of the Bulletin of WHO entitled "Global Disease Elimination and Eradication as Public Health Strategies". He also writes about the history of the launching of the OEPA initiative (Bull PAHO).
- **2000:** OEPA needed a 'definition of success' endorsed by WHO; with a push from President Carter, WHO agreed to hold an important meeting to establish certification criteria for onchocerciasis elimination (WHO 2001). These guidelines remain a key milestone and are used by OEPA and the Uganda program. Richards, writing in *Lancet*, notes the importance of the LF program in advancing the RB elimination agenda.
- **2002:** The Carter Center and WHO (with Gates Foundation support) co-hosted the Conference on RB Eradicability that concluded RB can be eliminated in the Americas but not yet throughout Africa with current tools (ivermectin alone). The challenge was noted of the parasite *Loa loa*, which occurs in some areas that have RB: ivermectin given to a person having *Loa loa* infection can result in severe nervous system reactions, including coma. (Dadzie 2003)
- **2003:** Richards coauthors a paper on mass treatment decision making in *Loa loa* areas where onchocerciasis occurs. (Addis 2003)
- **2005:** Paper published by Hopkins, Richards, and Katabarwa ("Whither Onchocerciasis Control in Africa?") challenges feasibility of indefinite RB control in Africa without continued external support. Calls for governments to do more to fund their programs, and calls for further research into RB elimination in Africa. (Hopkins 2005)
- **2006:** TCC agrees to assist Sudan in elimination efforts in the Abu Hamad focus on the River Nile. (Higazi 2011, 2013)
- **2007:** TCC's ITFDE reviews RB eradicability and notes evidence that ivermectin alone may interrupt transmission in Africa, but that the challenge of *Loa loa* is not resolved. (WHO 2007). TCC/RBP agrees to assist Uganda in its new goal of national RB elimination.
- **2008:** The Carter Center provided technical and financial assistance to help establish a national onchocerciasis expert advisory committee in Uganda.
- **2009:** A key WHO/TDR study by Diawara (2009) that was conducted in Senegal and Mali with Gates Foundation support (derived as an outcome of the 2001 Conference on Eradicability) proves RB elimination is possible with 17 years of ivermectin alone under some conditions in Africa. Gates, MDP, TCC and APOC all call for "Shrinking the Map" in Africa (WHO 2009). Rakers (TCC staff) reports that RB programs in Nigeria would collapse without external support, questioning the 'sustainability' theory.
- **2010:** TCC reports considerable success in RB elimination efforts in the Americas (series of *Weekly Epidemiological Record* articles) and parts of Africa. However, Katabarwa (TCC/RBP staff) notes a need to expand treatment into the so-called hypoendemic areas excluded by APOC's treatment strategies. He also challenges the

Diawara report by noting failures of once-per-year treatment with ivermectin alone for 17 years in TCC-assisted North Province, Cameroon; TCC calls for twice-per-year treatment in these areas (Katabarwa 2011). At an international conference TCC reports an analysis of the impact of annual ivermectin and albendazole (for lymphatic filariasis) on onchocerciasis transmission elimination in many areas of Plateau and Nasarawa States of Nigeria.

- **2011:** TCC's International Task Force for Disease Eradication reviews the RB and LF elimination efforts in Africa, applauds the move by APOC from RB control to elimination, and calls for better coordination of RB and LF interventions as well as with malaria bed net distribution efforts (*Weekly Epidemiological Record* 2011). An expert committee (with Frank Richards, the TCC RBP Director, as a member), meeting under the auspices of the World Bank, recommends an elimination goal for ten African countries by 2020, including Nigeria, Uganda, and Ethiopia. In late 2012, the World Bank/APOC governing board recommends onchocerciasis elimination now be APOCs goal.
- **2012:** Sudan announces interruption of transmission in Abu Hamad focus (Higazi 2013). TCC's River Blindness Program obtained Board of Trustees' approval for an eight-year plan to interrupt RB transmission everywhere we assist, by 2020. WHO sends verification team to Colombia to determine if the country has eliminated onchocerciasis.
- **2013:** The name of TCC's River Blindness Program was changed to The Carter Center's River Blindness Elimination Program (RBEP) to reflect the paradigm shift to focusing efforts on eliminating RB transmission everywhere we work. Colombia is the first country in the world verified by WHO to be free of onchocerciasis. Ecuador applies to WHO for verification of elimination.
- **2014:** WHO verifies that Ecuador has eliminated onchocerciasis. ITFDE reviews RB/LF in Africa again. Published in WER. The Carter Center provided technical and financial assistance to help establish a national onchocerciasis expert advisory committee in Ethiopia.
- **2015:** WHO verifies that Mexico has eliminated onchocerciasis and Guatemala requests verification. The Carter Center provided technical and financial assistance to help establish a national onchocerciasis expert advisory committee in Nigeria. Sudan announces that transmission has been eliminated in Abu Hamad focus.
- **2016:** WHO sends a verification team to Guatemala to determine if that country is onchocerciasis-free.

ANNEX 3: The Carter Center RBEP Reporting Processes

At-risk Villages (ARVS): An epidemiological mapping exercise was a prerequisite to identifying at-risk villages (ARVS) for mass Mectizan® treatment programs. The assessment techniques used in the mapping exercise in Africa varied from those used in the Americas. An overview of the two approaches follows.

In much of Africa, a staged village sampling scheme called Rapid Epidemiological Mapping of Onchocerciasis (REMO) was executed with assistance from WHO to define endemic "zones" that should capture most or all villages having onchocercal nodule rates ≥20% in adults (which roughly corresponds to a microfilariae in skin prevalence ≥40%) for mass treatment. The mapping strategy is based on studies that have shown that most ocular and dermal morbidity from onchocerciasis occurs in villages where the nodule prevalence exceeds 20%. In the first stage of REMO, survey villages are selected based on a review of large-scale maps of areas that appear to be environmentally able to support black fly breeding and, therefore, transmission of *O. volvulus*. In the second stage, the survey villages are visited by field teams and a convenience sample of 30-50 adults are examined (by palpation) for characteristic onchocercal nodules. The mean nodule prevalence for each village sample is mapped (often using geographic information systems) and the map is used to define endemic zones called 'community directed treatment with ivermectin (CDTI) treatment zones.' These zones typically are defined by sample villages having nodule prevalence of ≥20 %. All villages within the CDTI treatment zone are offered mass Mectizan® treatment annually. This approach is modified for areas where the parasite *Loa loa* exists. The approach of REMO excludes some areas from CDTI, where there may be onchocerciasis but nodules rates are under 20% (the so-called "hypoendemic areas"). As the policy shifts from control to elimination, the role of hypoendemic areas in *O. volvulus* transmission is being critically re-examined. The River Blindness Elimination Program (RBEP) contributes to this area of investigation in our assisted areas (see Katabarwa, *Trop Med Int Health*. 2010; 15:645-52). Based on evidence we have collected, we firmly believe that transmission occurs in some hypoendemic areas and that they must therefore be promptly reassessed and if necessary treated with CDTI under the elimination approach.

With onchocerciasis elimination policy launched in the countries we support, any areas in a country not yet mapped are continuing with mapping based on the REMO system. Within a selected community, 100 resident children (ages 5 to <10) and 10 resident adults (> 20 years) are tested for OV16 antibody either by ELISA or by rapid diagnostic test (Oguttu et al, 2014). Results from the three (or more) villages visited will be combined in the final analysis. In accordance with national guidelines, MDA is indicated if the point prevalence of OV16 antibody in kids for the area is =>1%, and/or the point prevalence for OV16 in adults (aged>20 years) is >10%.

In the Americas, the goal is to eliminate both morbidity and transmission from *O. volvulus* and, as a result, all villages where transmission can occur are considered "at- risk" and are offered mass Mectizan® treatment activities every three or six months. Thus, a broader net is cast for mass treatment where elimination is the goal and the concept of

excluding hypoendemic villages does not exist. For the Americas, where the endemic foci are characteristically smaller and more defined than Africa, every village in known or suspected endemic areas has a rapid epidemiological assessment of 50 adults, who have both nodule examinations and superficial skin biopsies to identify *O. volvulus* microfilaria in skin. Villages in which one or more persons are positive (sample prevalence ≥2%) are considered "at-risk" and are recommended for the mass treatment campaign. Thus, the cutoff prevalence for treatment was much lower for the Americas compared to Africa until recently when elimination in Africa became the focus.

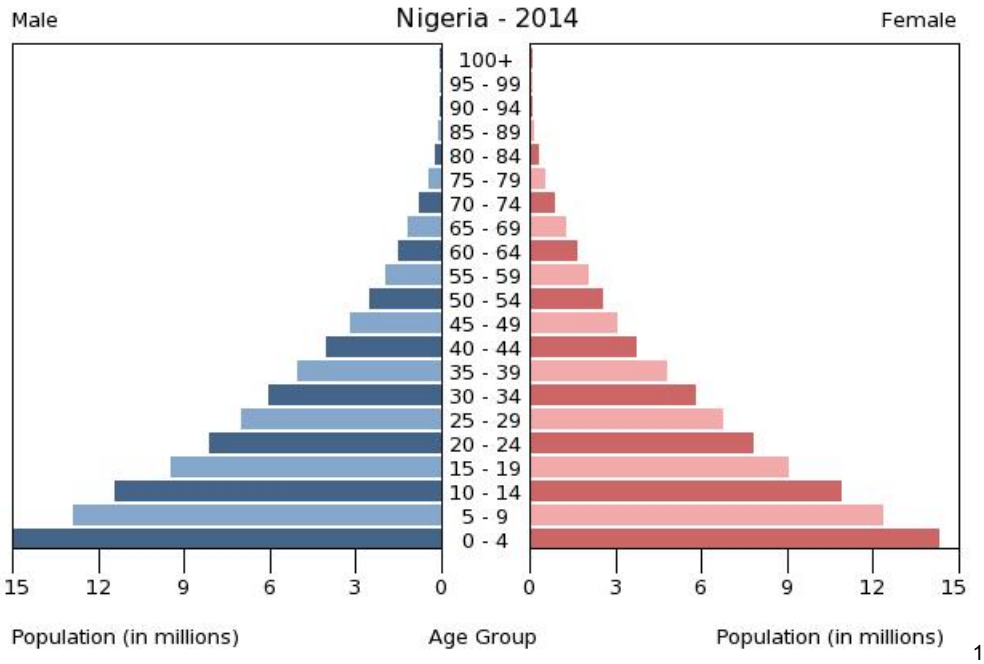
Data Reporting: The Carter Center program offices report monthly to The Carter Center headquarters in Atlanta. These reports include: 1) numbers of villages and persons treated during the previous month (reporting of treatments are updated quarterly for the Americas); 2) the status of the Mectizan® tablet supply; 3) training and health education activities; 4) epidemiological assessment, research, and program monitoring activities; and 5) administrative issues. Standardized tables and graphs are used across programs. The treatment data that are reported originate from village level records prepared during mass treatment activities carried out by village distributors and/or national Ministry of Health (MOH) personnel. The accuracy of these reports is routinely confirmed with random spot checks performed primarily by MOH personnel, supplemented by a standardized monitoring questionnaire administered by The Carter Center and MOH staff. Summary reports of numbers of villages and persons treated are compiled at the district level and forwarded (whenever possible through MOH surveillance and reporting channels) to both headquarters of the national onchocerciasis programs and the national Carter Center offices. In the Americas, the MOHs in the six countries report treatments quarterly to the OEPA office in Guatemala City, which then provides a combined regional report to The Carter Center and to the Program Coordination Committee (PCC), InterAmerican Conference on Onchocerciasis (IACO) and the Pan American Health Organization (PAHO)/World Health Organization (WHO) in its regular meetings; OEPA updates are provided in WHO's annual *Weekly Epidemiological Record (WER)* articles (See Annex 8). African MOHs report their annual results directly to WHO and APOC, which has recently begun publishing its results in the WER as well.

The data from monthly reports are supplemented with additional information at the annual Carter Center River Blindness Elimination Program Review held during the first quarter of the following year. At these reviews, all Carter Center program directors and other partners convene to finalize treatment figures for the previous year and establish new treatment objectives for the coming year. Data on Mectizan® treatments provided by other programs/partners operating in other parts of the countries where The Carter Center assists also are discussed (if these data are available), as well as results from research initiatives. The Carter Center reports its final annual treatment figures to the Mectizan Donation Program (MDP), Merck, and the NGDO Onchocerciasis Coordination office at the WHO, Geneva.

RBEP Treatment Indices: Treatments are reported as numbers of persons and number of at-risk villages (ARVS) treated for the month by district, focus, region, state or zone, depending on the geographical stratification of the country. Cumulative treatment figures

for the year are compared to the Annual Treatment Objectives (ATOs) or Ultimate Treatment Goals (UTGs). The decision on whether to use ATOs or UTGs is based on projections of program capacity. Mature programs that sufficiently reach all targeted communities within their entire program area are said to be at "full geographic coverage," and use the UTG index as their coverage denominator (see below). UTG figures typically increase by about five percent annually to account for normal population growth.

The eligible populations of at-risk villages (ARVS) targeted for active mass distribution receive community-wide Mectizan® treatment. The eligible at-risk population (EARP) includes all persons living in ARVS who are eligible to receive Mectizan® (i.e., who are either ≥5 years of age, ≥15 kg in weight, or ≥90 cm in height, and who are in good health). Although RBEP mass treatment activities exclude pregnant women, these women should be treated later during the treatment year (treatment may be given one week or more after parturition) and therefore all adult women are included in the UTG calculation. In practice, the UTG is established by ARV census from the most recent treatment rounds. The UTG is expected to be the same figure used in the annual request for tablets submitted to the Mectizan Donation Program. WHO uses total population as their treatment denominator, so RBEP routinely reports both coverage of eligible population (UTG) and coverage of total population ("therapeutic coverage") to satisfy those program's needs. The rationale for RBEP's focus on the UTG denominator has been published (Richards et al., *American Journal of Tropical Medicine and Hygiene* 2001; 65:108-14). In general, total population coverage is 18-20% less than UTG (eligible) population coverage, in accord with population pyramids in areas being served, where approximately 20% of the population is under 5 years of age or otherwise (sick or pregnant) ineligible for Mectizan® treatment (see example below, Nigeria).



[1]

[1] Source: CIA Factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html.

The UTG(2) and UTG(4) denominators are used by elimination programs where semiannual or quarterly treatments are delivered: the values are twice or four times the UTG, and represent treatments delivered, not persons treated. Full coverage in control programs is defined as 90% achievement of the UTG established for active mass treatment. Full coverage for elimination programs is 90% of the UTG(2) in African projects, or 85% of the UTG(2) or UTG(4) for OEPA. The differences in full coverage thresholds result from different recommendations by the African and American expert steering committees. Passive treatments are Mectizan® treatments for onchocerciasis provided through health care units located in hypoendemic communities (where estimated onchocerciasis nodule prevalence is under 20%) in the control program strategy. As the program transitions to the elimination paradigm, hypoendemic villages are beginning to receive mass treatment and the passive treatment strategy is no longer applicable.

ANNEX 4: List of Program Review Participants (*attendees of all 20 reviews)

The Carter Center Atlanta
Dr. Stephen Blount
Ms. Kelly Callahan
Ms. Kenya Casey
Mr. Yohannes Dawd
Mr. Don Denard
Ms. Emily Griswold
Ms. Jennifer Hallaman
Mr. Andrew Heacox
Ms. Madelle Hatch
Ms. Alicia Higginbotham
Dr. Don Hopkins
Ms. Lauri Hudson-Davis
Dr. Moses Katabarwa*
Ms. Nicole Kruse
Ms. Sasithorn Maneeratanamongkol
Mr. Jarod Mooney
Dr. Mesrak Nadew
Mr. Scott Nash
Dr. Gregory Noland
Amb. Mary Ann Peters
Ms. Lindsay Rakers
Ms. Julia Rankine
Dr. Frank Richards*
Mr. Randall Slaven
Ms. Shelley Smart
Ms. Emily Staub
Ms. Aisha Stewart
Ms. Shandal Sullivan
Mr. Marc Tewari
Mr. Craig Withers

The Carter Center Field Office Staff
Mr. Aderajew Abdulkadir - Ethiopia
Dr. Nabil AwadAlla – Sudan
Mr. Edson Byamukama - Uganda
Mr. John Eguagie - Nigeria
Dr. Abel Eigege - Nigeria
Dr. Emmanuel Emukah – Nigeria
Ms. Peace Habomugisha - Uganda
Dr. Emmanuel Miri – Nigeria*
Mr. Adamu Sallau – Nigeria
Dr. Mauricio Sauerbrey - Americas
Dr. Zerihun Tadesse – Ethiopia
Mr. Abate Tilahun - Ethiopia

Centers for Disease Control & Prevention
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Dr. Vitaliano Cama
Dr. Paul Cantey
Dr. Mark Eberhand
Dr. LeAnne Fox
Dr. Julie Gutman
Dr. Patrick Lammie
Dr. Monica Parise
Dr. Laurence Slutsker

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Mr. Melsew Chanyalew - Ethiopia
Mr. Thomson Lakwo – Uganda
Dr. Isameldin Mohammed - Sudan
Dr. Edridah Tukahebwa Muheki – Uganda
Mr. Biruck Kebede Negash - Ethiopia
Mrs. Ifeoma Nkiruka – Nigeria
Prof. Bertram Nwoke – Nigeria
Mr. Isam Zarroug - Sudan

University and NGDO Personnel and Special Guests
Mr. Omuer Shafi Abduraham – Emory University
Mr. Phillip Albano – Lions Club International
Hon. Tebebe Y. Berhan – Lions Club International
Ms. Nsa Dada
Dr. Elizabeth Elhassan - Sightsavers
Dr. Darin Evans – USAID
Ms. Tina Flores – Rabin Martin
Dr. Katherine Gass - Task Force for Global Health
Dr. Danny Haddad – Emory University
Ms. Elizabeth Heilman – Emory University
Dr. Rafe Henderson
Dr. Tariq Higazi – Ohio University
Dr. Adrian Hopkins – Mectizan Donation Program
Prof. Rory Post – Liverpool John Moore University
Mr. Archille Kabore - RTI International
Mr. Elie Kamate - Sightsavers
Ms. Joni Lawrence - Task Force for Global Health
Ms. Helen Lim - Task Force for Global Health
Dr. Deborah McFarland – Emory University
Mr. Edwin Michael – University of Notre Dame
Mr. Polly Kalamari Ndyarugahi – Lions of Uganda
Dr. Johnson Ngorok - Sightsavers
Mr. Benjamin Nwobi - RTI International
Dr. Kisito Ogoussan - Task Force for Global Health
Dr. Eric Ottesen - Task Force for Global Health
Mr. Roger Peck - PATH
Dr. Mark Rosenberg - Task Force for Global Health
Dr. Dave Ross – Task Force for Global Health
Ms. Alexis Serna - RTI International
Dr. Yao Sodahlon – Task Force for Global Health
Dr. Jeffrey Sturchio – Rabin Martin
Ms. Jamie Tallant – The END Fund
Dr. Thomas Unnasch - University of South Florida
Dr. Tony Ukety – World Health Organization

ANNEX 5: Agenda

Twentieth Annual Carter Center River Blindness Elimination
Program Review Agenda
Wednesday, March 2 – Friday, March 4, 2016
The Carter Center, Atlanta, GA

Day 1: Wednesday, March 2, 2016

8:00	***Shuttle Pickup at Hotel***	
8:30 – 9:00	***Continental Breakfast***	
9:00 – 9:40	Welcome and Overview and Introduction	Dr. Frank Richards
Morning Session Chair: Dr. Mauricio Sauerbrey		
9:40 – 10:10 10:10 – 10:20	Nigeria: Plateau and Nasarawa States Treatments *Discussion*	Dr. Abel Eigege
10:20 – 10:55	***Coffee Break and Group Photo***	
10:55 – 11:15 11:15 – 11:25	Nigeria: MIS Survey Update and Expansion of CDD LLIN work in SE Nigeria *Discussion*	Dr. Adamu Sallau
11:25 – 11:55 11:55 – 12:10	Nigeria: Impact, Training, Integration and Community Ownership *Discussion*	Dr. Emmanuel Miri
12:10 – 12:20 12:20 – 12:30	Nigeria: Update on Post-Treatment Surveillance (PTS) in Plateau and Nasarawa and Upcoming Operational Research Plans *Discussion*	Dr. Gregory Noland
12:30 – 2:00	***Lunch***	
Afternoon Session Chair: Ms. Peace Habomugisha		
2:00 – 2:55 2:55 – 3:10	Nigeria: TCC-assisted Southeast States Treatment Activities *Discussion*	Dr. Emmanuel Emukah
3:10 – 3:25 3:25 – 3:35	Nigeria Onchocerciasis Elimination Committee Update *Discussion*	Prof. B.E.B Nwoke
3:35 – 3:45 3:45 – 3:55	Nigeria: Hypo-endemic Oncho and *Loa loa* Protocol in SE Nigeria *Discussion*	Dr. Emmanuel Emukah
3:55 – 4:25	***Coffee Break***	
4:25 – 4:35 4:35 – 4:45	Nigeria: Coverage Surveys Planned for 2016 *Discussion*	Ms. Emily Griswold
4:45 – 4:55 4:55 – 5:10	Drug Delays *Discussion*	Ms. Lindsay Rakers
5:10 – 5:25 5:25 – 5:35	Mectizan Donation Program Update *Discussion*	Yao Sodahlon
5:35	***Session Adjourned***	
6:00-8:00	***Reception: The Carter Center "Kitchen @ Copenhill"***	
8:00	***Shuttle Departs for Hotel***	

Day 2: Thursday, March 3, 2016

8:00	***Shuttle Pickup at Hotel***	
8:30 – 9:00	***Continental Breakfast***	
Morning Session Chair: Dr. Nabil Aziz		
9:00 – 10:00 10:00 – 10:30	OEPA Overview 2015 with Focus on Yanomami Area *Discussion*	Dr. Mauricio Sauerbrey
10:30 – 11:00	***Coffee Break***	
11:00 – 11:15 11:15 – 11:25	NASA Remote Sensing Project Results *Discussion*	Ms. Lindsay Rakers
11:25 – 11:55 11:55 – 12:25	Uganda: Treatments *Discussion*	Ms. Peace Habomugisha
12:00 – 1:30	***Lunch***	
Afternoon Session Chair: Dr. Zerihun Tadesse		
1:30 – 1:45 1:45 – 1:55	Uganda Onchocerciasis Elimination Expert Advisory Committee *Discussion*	Dr. Thomas Unnasch
1:55 – 2:25 2:25 – 2:40	Uganda: Onchocerciasis Elimination, Impact and PTS Update *Discussion*	Dr. Thomson Lakwo
2:40 – 3:00 3:00 – 3:10	Onchocerciasis: Shift from Control to Elimination - Vector Control Shall Not Remain Under a Bushel. Prospects for Madi-Mid North Focus - Uganda *Discussion*	Dr. Moses Katabarwa
3:10 – 3:35	Uganda: Training, Integration and Community Ownership	Ms. Peace Habomugisha
3:35 – 4:05	***Coffee Break***	
4:05 – 4:20	*Discussion*	Ms. Peace Habomugisha
4:20 – 5:05 5:05– 5:20	Update: Uganda, Seri (LF) and Bayan Dutse Update *Discussion*	Prof. Edwin Michael
5:20	***Session Adjourned***	
5:25	***Shuttle Departs for Hotel***	
6:30	***Atlantic Station Shopping Trip – Pickup from Hotel***	

Day 3: Friday, March 4, 2016

8:00	***Shuttle Pickup at Hotel***	
8:30 – 9:00	***Continental Breakfast***	
Morning Session Chair: Dr. Emmanuel Miri		
9:00 – 9:30 9:30 – 9:45	Ethiopia: Treatments *Discussion*	Mr. Abate Tilahun
9:45 – 10:05 10:05 – 10:15	Ethiopia: Impact of LF/RB Programs *Discussion*	Mr. Aderajew Mohammed
10:15 –10:25 10:25 – 10:35	Ethiopia Onchocerciasis Elimination Expert Advisory Committee Update *Discussion*	Dr. Mark Eberhard
10:35 – 11:05	***Coffee Break***	
11:05 – 11:35 11:35 – 11:50	Ethiopia: Training, Integration and Community Ownership *Discussion*	Dr. Zerihun Tadesse
11:50 – 12:00 12:00 – 12:05	The Revised WHO Guidelines for Stopping MDA and Verifying Elimination of Human Onchocerciasis *Discussion*	Dr. Tony Ukety
12:05 – 12:15 12:15– 12:25	Update on CDC Onchocerciasis Research *Discussion*	Dr. Vitaliano Cama
12:25 – 2:00	***Lunch***	
Afternoon Session Chair: Dr. Frank Richards		
2:00 – 2:30 2:30 – 2:40	Sudan: Abu Hamad free; Next is Galabat *Discussion*	Dr. Asam Zroug
2:40 – 3:00 3:00 – 3:10	Sudan: The Challenge of Khor Yabus and Radom *Discussion*	Dr. Nabil Aziz
3:10 – 3:40	***Coffee Break***	
3:40 – 4:00 4:00 – 4:10	Cross-Border Special Intervention Zones *Discussion*	Dr. Frank Richards Prof. Rory Post
4:10 – 4:25 4:25 – 4:35	RB and LF Mapping in Carter Center-Assisted Countries in Africa – TFGH/AFRO Discussion	Dr. Eric Ottesen
4:35 – 4:40	Comments	Dr. Donald Hopkins
4:40 – 4:45 4:45 – 4:50	Community Forms Report *Discussion*	Dr. Edridah Muheki Tukahebwa
4:50 – 4:55 4:55 – 5:00	Drug Supply Report *Discussion*	Mrs. Ifeoma Anagbogu
5:00 – 5:10 5:10 – 5:15	Hydrocele *Discussion*	Dr. Danny Haddad
5:15 – 5:45	**Summary and Closure of the Twentieth Session**	Dr. Frank Richards
5:45	***2015 Carter Center River Blindness Program Review Adjourned***	
5:45	***Shuttle Departs for Hotel***	

ANNEX 6: River Blindness Elimination Program Review Contact List

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ANNEX 7: The Lymphatic Filariasis (LF) Elimination Program

LF in Africa is caused by *Wuchereria bancrofti*, a filarial worm that is transmitted in rural and urban areas by *Anopheline* and *Culex sp*. mosquitoes, respectively. The adult worms live in the lymphatic vessels and cause dysfunction, often leading to poor drainage of lymphatic fluid. Clinical consequences include collection of lymph that results in swelling of limbs and genital organs (lymphoedema, "elephantiasis" and hydrocele), and painful recurrent bacterial infections ('attacks' of acute adenolymphangitis). The female worms release microfilariae, which are tiny embryonic worms that circulate in blood at night, when the mosquito vectors bite. Microfilariae are picked up by mosquitoes, develop over several days into infectious larvae, and are then able to be transmitted to another person when the mosquitoes bite again. Microfilariae are killed by annual single-dose combination therapy, with either Mectizan® (donated by Merck) and albendazole (donated by GSK), or diethylcarbamazine (DEC) and albendazole (in areas where there is no onchocerciasis and/or *Loa loa* infection). Annual mass drug administration (MDA) prevents mosquitoes from becoming infected, and when given for a period of time (estimated to be five to six years), can interrupt transmission of *W. bancrofti* (which has no animal reservoir). In 2013, the WHO issued a 'provisional strategy' for *Loa loa* areas that includes the dual approach of albendazole monotherapy via MDA once or twice-per-year, together with long-lasting insecticidal (bed) nets (LLIN).

Nigerians suffer in disproportionate numbers from LF. Disease mapping of the country confirms that Nigeria is third globally behind India and Indonesia in the human suffering from this parasite. With 761 out of 774 LGAs of 36 States and the Federal Capital Territory mapped, 574 LGAs (75%) are endemic and over 100 million Nigerians are at risk. The Carter Center, working with the Federal Ministry of Health (FMOH) of Nigeria and with the state and local government ministries in Plateau and Nasarawa states, has assisted in establishing an LF elimination program in Plateau and Nasarawa states. The effort is based on a strategy of health education (HE) and annual drug combination therapy with albendazole and Mectizan®. The manufacturers of the drugs have global donation programs for LF: GSK donates albendazole and Merck donates Mectizan®. After years of high treatment coverage, LF has been eliminated in the two states, and they are now under post-treatment surveillance for five years. Through a grant from the Bill & Melinda Gates Foundation, The Carter Center also conducted field research on the use of LLINs alone to combat LF in Imo and Ebonyi states, which are areas where LF MDA with Mectizan® is not currently possible due to the presence of *Loa loa*. Results showed LLINs have had significant impact on mosquito infection (Richards et al., *Am J T Med Hyg* 2013). Thanks to the Global Fund Round 8, LLINs have now been mass distributed for malaria prevention, two per household, in the majority of Nigeria; this supplements health education and drug combination therapy as one more way to fight LF. The national malaria and lymphatic filariasis programs are actively involved in The Carter Center-assisted program, and The Carter Center has assisted (in differing degrees) in the mass distribution of LLINs in all nine states where we work. Due in part to strong Carter Center advocacy, Nigeria launched its FMOH Guidelines for Malaria-Lymphatic Filariasis Co-implementation in Nigeria in June 2013. We feel this opportunity

for synergy should not be missed and continue to work in integrated LF/Malaria work in Carter Center assisted states, even though the Center's Malaria Program closed in 2014.

Most recently, LF treatments in Nigeria have expanded to the seven states we assist in the southeast, as part of the USAID ENVISION project, led by RTI International. Treatments started in 2014 in areas with an existing river blindness program, and in 2015 expanded to address all LF-endemic areas in the nine states. The provisional albendazole alone monotherapy (together with LLIN) is in force in some areas in those states based on Loa loa endemicity there.

The LF program in Ethiopia was launched in 2008, starting with LF surveys for antigenemia conducted in several zones in western Ethiopia in areas where MDA for RB was ongoing (results reported in Shiferaw et al. *Trans Royal Soc Trop Med Hyg* 2011). With GSK support, The Carter Center assisted in the launching of a Ministry of Health LF elimination pilot program in 2009 that provided roughly 75,000 treatments annually. Now the program is delivering over one million treatments each year. Although LF mapping for Ethiopia has been completed, the Federal Ministry of Health has identified the need for further map refinement (Rebollo et al., *PLoS Negl Trop Dis* 2015). The Ethiopian Malaria Program has completed the mass distribution of LLINs throughout the malaria endemic areas of Ethiopia. The Carter Center has assisted (again in differing degrees) in this distribution in those regions we assist. These LLINs are undoubtedly impacting LF transmission.

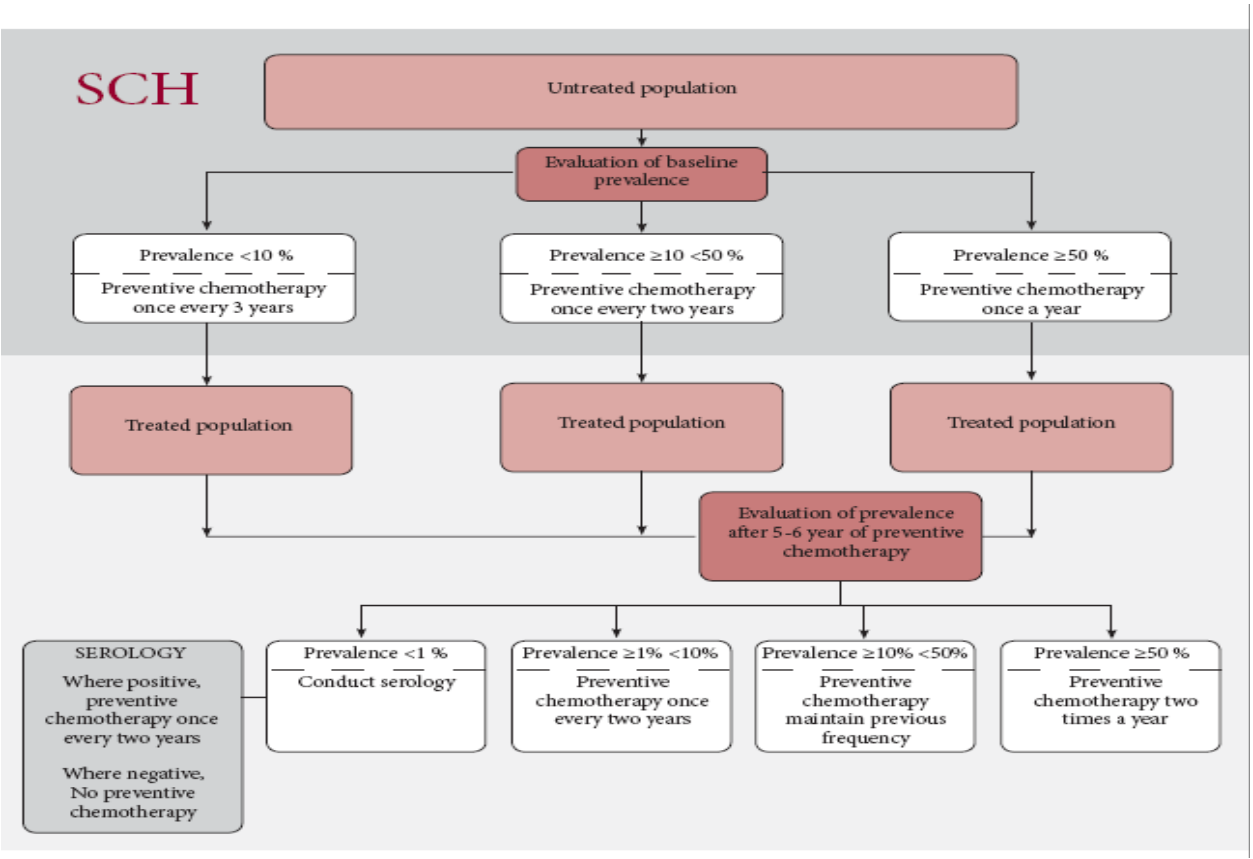
ANNEX 8: The Schistosomiasis/Soil Transmitted Helminthiasis Control Program

SCHISTOSOMIASIS

Schistosomiasis (SCH) is acquired from contact with infected fresh water. Cercariae, released from infected snails, penetrate the skin and develop into adult worms that reside in venules of the intestines (*Schistosoma mansoni*) or bladder and genitals (*S. haematobium*). It is important to note that SCH is really two different infections with different geographical distributions, human epidemiology and disease patterns (morbidity). In both conditions, female worms lay thousands of eggs that exit the body in feces (*S. mansoni*) or urine (*S. haematobium*). If the eggs gain access to fresh water, they hatch and release miracidae, which swim in search of certain types of snails (*S. mansoni* infects *Biomphalaria species*; *S. haematobium* infects *Bulinus species*) that they penetrate and infect. In the snails, a miracidium transforms and multiplies, resulting in a single snail releasing thousands of cercariae, thus continuing the lifecycle. Disease from schistosomiasis comes from the inflammation caused by the eggs deposited into human tissues by the adult female worms. These eggs cause inflammation, organ damage, bleeding, and anemia. Although all age groups are infected, school-aged children (ages five to 14) have the greatest number of adult worms, and act as the main disseminators of this infection by passing large numbers of eggs in their urine and feces. MDA with the safe and effective oral medicine praziquantel can significantly reduce schistosomiasis morbidity. Praziquantel kills the adult worms and so reduces the number of eggs that accumulate in tissues, and as a result reduces the disease (morbidity) associated with schistosomiasis. However all age groups would need to be treated to have the greatest impact on transmission.

SCH programs are for morbidity control; transmission is unlikely to be interrupted until open defecation and urination (and reduction of release of raw sewage into fresh water) is halted through deployment and use of sanitary systems. MDA with praziquantel under current WHO guidelines will have little no impact on infected snails (which live for many months), or developing (pre-adult) worms in humans. In other words, persons treated are not cured of their developing infections, or become reinfected within days of receiving praziquantel treatment.

The current WHO guidelines for schistosomiasis treatment (below) focus on providing treatment to school aged children:



SOIL-TRANSMITTED HELMINTHS

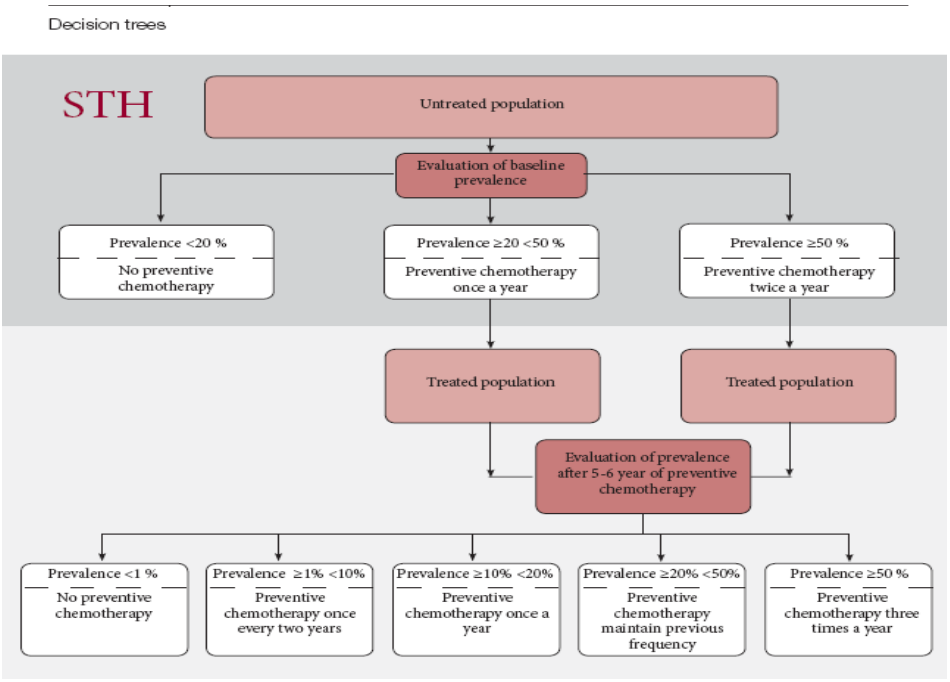
Soil-Transmitted Helminthiasis (STH) is caused by a group of at four different intestinal worms that infect humans. STH are among the most common infections worldwide and heavy infections lead to developmental delay, malnutrition, intestinal obstruction, and anemia (depending on the infecting species). The causal agents in humans are the following intestinal lumen dwelling nematodes: *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), or *Ancylostoma duodenale* and *Necator americanus* (hookworms).

Transmission of soil transmitted helminths occurs through feces. Eggs from the adult females are passed into the environment in feces, where they become infective within days (hookworm and whipworm) or weeks (roundworm). Once in the environment, infective eggs are passed to humans either by ingestion of fecally contaminated food or water (*Ascaris* and *Trichuris*) or through penetration of skin by larvae (*Ancylostoma* and *Necator*). The infective eggs of the whipworm hatch, mature, mate, and lay eggs in the intestines within 70-90 days. Both the roundworm, once hatched, and hookworm will migrate through the circulatory system until they reach the lungs. From there, they pass

through the trachea and mouth where they are ingested, traveling from there to the intestines. They then mature, mate, and release eggs within 6-8 weeks.

Heavy infections result in blood loss leading to increased risk of anemia and hypoproteinemia which, in children, can lead to poor physical and developmental growth causing stunting and decreased mental acuity. In adults, this may reduce productivity. In some cases, pulmonary complications can occur caused by the migration of roundworm or hookworm larvae through the lungs and in the case of *Ascaris,* bowel obstructions can occasionally lead to death. Hookworms have their highest prevalence in adults, but the current WHO guidelines (below) focus on STH control through MDA targeted at school aged children. STH programs are for morbidity control; transmission will not be interrupted until open defecation is halted through deployment and use of sanitary systems.

It is notable that the different species of worms have different sensitivities and cure rates from the MDA regimens provided: 1) albendazole is superior to mebendazole, and ascaris is most sensitive to treatment, while trichuris is least sensitive.



The challenges in implementing schistosomiasis and STH programs in TCC Nigeria programs have included: 1) complex WHO guidelines (shown above); 2) unclear global goals (control versus elimination, the latter requiring a major sanitation infrastructure investment); 3) alternating year treatment schedules for schistosomiasis (including treatment programs every third year); 4) twice-per-year treatment programs for STH; 5) focus on ministry of education partners ('school-based') rather than ministry of health, which has been the traditional partner of the TCC integrated RBEP; 6) focus on teachers (in schools) rather than community distributors (house to house); 7) exclusion of potentially infected preschool children and adults (in most cases); 8) algorithms with thresholds statistically indistinguishable from one another; 9) mapping based on averages result in exclusion of communities that need interventions; 10) difficult calculations of coverage due to challenges with denominator determinations; 11) difficulty in justifying the closure of a long-standing infrastructure (community-based interventions) that work well, to start a new approach (school-based), and 12) loss of high quality STH control resulting from community wide LF MDA with the most potent STH treatment (ivermectin and albendazole) with closure of LF programs that pass TAS assessments.

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